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Santa Clara Valley Water District

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SANTA CLARA VALLEY WATER DISTRICT

WATER CONDITIONS

ANNUAL REPORT

DRAFT

by

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TABLE OF CONTENTS

		Page
I.	SUMMARY OF 1978-79 WATER CONDITIONS	1
II.	INTRODUCTION	2
III.	HYDROLOGIC BALANCE	4
IV.	GROUNDWATER	11
	A. Groundwater Levels	11
	B. Groundwater Recharge	13
	C. Land Surface Subsidence	13
	D. Groundwater Quality	15
	1. General	15
	2. Saltwater Intrusion	18
V.	SURFACE WATER	20
	A. Precipitation	20
	1. Weather Modification	22
	B. Imported Water	23
	1. South Bay Aqueduct	23
	2. Hetch Hetchy	25
	3. San Felipe Project Status	25
	C. Water Conservation	26
	1. Local Storage Reservoirs	26
	2. Water Reclamation	27
	2.1 Water Reclamation Facility, Palo Alto	27
	2.2 Water Reclamation Facility, Gilroy	29
	2.3 Water Reclamation Study, North San Jose-Milpitas	29
	2.4 Water Reclamation Study, Santa Clara Valley	30
	2.5 San Francisco Bay Area Regional Wastewater Reclamation Study	30
	3. Water Savings Program	31
	D. Surface Water Quality	31
	1. Streams	31
	2. Reservoirs	32
VI.	GLOSSARY	34

21R136t

TABLES

		Page
1.	Water Use Summary - Santa Clara Valley Groundwater Subbasin	9
2.	Reservoir Storage on October 1, 1978 and September 30, 1979	27

FIGURES

Figure 1-A	Hydrologic Balance of Groundwater 1978-79	5
Figure 1-B	Hydrologic Balance of Groundwater 1978-79	6
Figure 2	Historical Water Supply and Use, Santa Clara Valley Subbasin	8
Figure 3	Water Supply and Use - Santa Clara Valley Groundwater Subbasin	10
Figure 4	Index of Groundwater Levels	12
Figure 5	Groundwater Quality Variations in Selected Wells	16
Figure 6	Accumulated Annual Departure from 105-Year Average Rainfall at San Jose	21
Figure 7	Water Conveyance, Treatment and Distribution System	24

PLATES

1. Groundwater Basins and Water Zones
2. Lines of Equal Groundwater Elevation as Measured in Wells in September, 1979
3. Lines of Equal Change in Water Elevation in Wells from October 1978 to September 1979
4. Lines of Equal Depths to Water as Measured in Wells in September 1979
5. Generalized Chloride Content of Groundwater in the 0-100-Foot Depth Zone During 1972-78

I. SUMMARY OF 1978-79 WATER CONDITIONS

During the period October 1, 1978 through September 30, 1979, precipitation was below average in the Santa Clara Valley, Coyote and Llagas subbasins. As a consequence, the volume of groundwater in storage in the subbasins was either decreased or maintained at last year's levels. The Santa Clara Valley subbasin at the end of 1978-79 showed a decrease in the volume of groundwater in storage of 22 million[1/] cubic metres (18 thousand acre-feet), in the Coyote Groundwater Subbasin the volume of water in storage remained unchanged, and the Llagas Groundwater Subbasin showed an increase of two million cubic metres (two thousand acre-feet).

The volume of water stored in the District's conservation reservoirs decreased during the same period by 38 million cubic metres (31 thousand acre-feet). None of the reservoirs were full during the period of the report which, at maximum stage, averaged 65 percent of capacity.

During the 78-79 fiscal year, the District imported 130 million cubic metres (106 thousand acre-feet) of water through the South Bay Aqueduct. The Rinconada Water Treatment Plant treated 59 million cubic metres (48 thousand acre-feet) of this water, the Penitencia Water Treatment Plant treated 23 million cubic metres (19 thousand acre-feet) and 48 million cubic metres (39 thousand acre-feet) was released for groundwater recharge or direct use. Hetch Hetchy deliveries to Santa Clara County amounted to 62 million cubic metres (50 thousand acre-feet) during 1978-79.

Significant subsidence has been effectively halted since 1969. This is the result of groundwater levels having risen above and having remained above the critical pressure elevation.

Groundwater continues to be high-quality water usable for all beneficial purposes although certain localized areas have yielded groundwater of poor mineral quality.

1/ One million cubic metres = 1×10^6 cubic metres
1×10^6 cubic metres = 811 acre-feet
1 acre-foot = 1,233 cubic metres

II. INTRODUCTION

An aspect of the District's water resources management program includes monitoring and evaluating water use and water supplies, analyzing and updating projected water needs, and planning and implementing projects to meet the needs of the County. A major objective of the management program is to coordinate and optimize the use of the District's total water supplies, including local surface water, groundwater, imported water, and reclaimed wastewater.

This annual report covers the period from July 1, 1978 to September 30, 1979. Its purpose is to inform the District Board of Directors and interested citizens of the current condition of the County's water resources. The report deals with all the components of the hydrologic cycle.

The three major groundwater subbasins, which are interconnected and occupy about 970 square kilometres (375 square miles nearly 30 percent of the total County area), are the Santa Clara Valley, Coyote and Llagas Subbasins and are shown on Plate 1. Groundwater supplies about half of the total water used in the Santa Clara Valley Subbasin and almost all of that used in the Coyote and Llagas Subbasins. The remainder is supplied from local surface diversions and imported sources.

Zones of benefit have been established for the conservation, importation, treatment and distribution of water used in Santa Clara County and are shown on Plate 1.

Zone W-2 encompasses the Santa Clara Valley Groundwater Subbasin and was formed for the registration of those groundwater producing facilities that benefit from recharge of the groundwater basin by the District with local and imported water. In this zone, a charge is levied for groundwater extracted and the revenue thus derived is used to support the District's conservation and importation program.

Major sources of water supply income are the groundwater charge levied in Zone W-2 and the sale of treated water. The groundwater charge for nonagricultural uses during 1978-79 was $31.70 per thousand cubic metres ($39 an acre-foot), and for

agricultural uses the groundwater charge was $7.90 per thousand cubic metres ($9.75 an acre-foot). Treated water was sold at $64.80 per thousand cubic metres ($80 an acre-foot), with water in excess of contracted amounts sold at $42.90 per thousand cubic metres ($53 an acre-foot).

In 1978-79, the District received about one third of its revenue from ad valorem property taxes. With implementation of Proposition 13, the District no longer levied Water Fund, Zone W-3 or Zone W-4 taxes. Instead, it received a portion of the one percent Countywide tax revenue as allocated by the County Assessor in accordance with State Senate Bill 154. It did levy taxes to pay debt service on prior approved general obligation bonds. The major debt service tax was levied in Zone W-1 to repay general obligation bonds authorized in 1963.

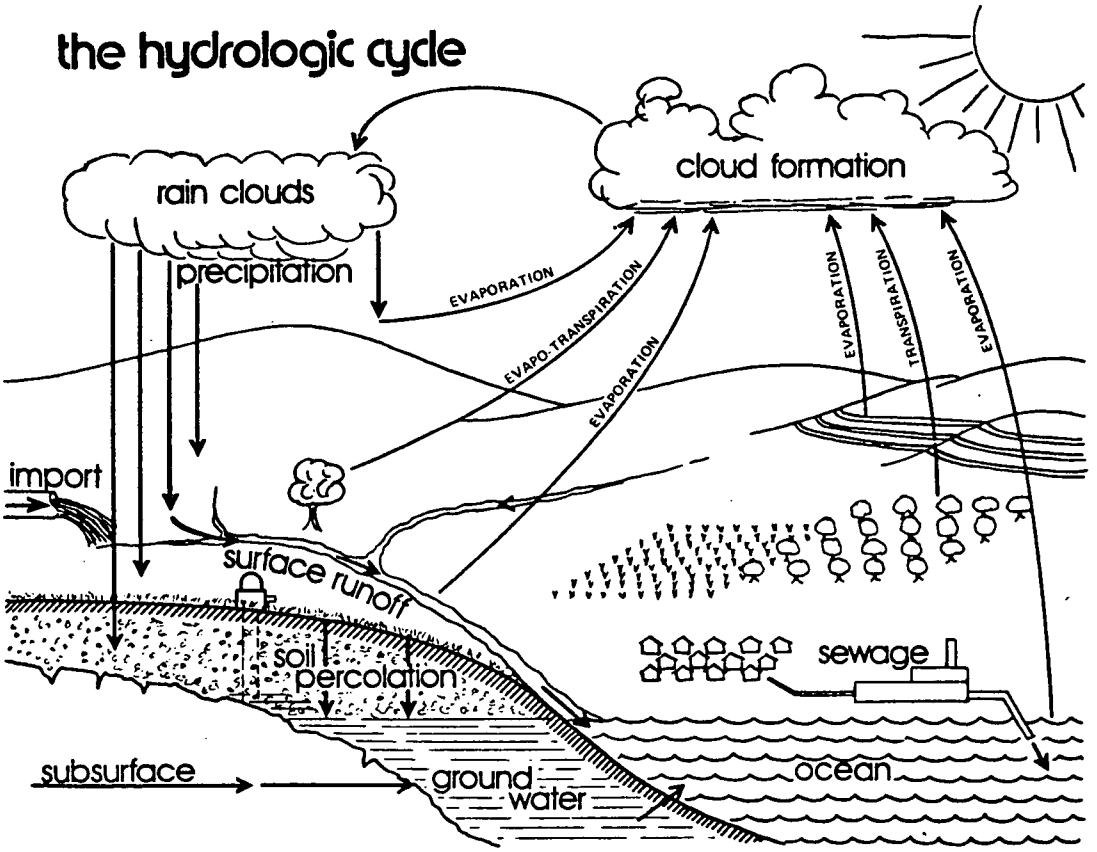
III. HYDROLOGIC BALANCE

Seasonal rainfall in Santa Clara Valley was below average in 1978-79. The San Jose Municipal Weather Station No. 86, which averages 357 millimetres per year, based on 105 years of record, recorded 308 millimetres (86 percent of normal) and 422 millimetres (also 86 percent of normal) were recorded at the U. S. Weather Bureau Station No. 28 at Gilroy, which averages 488 millimetres.

None of the conservation reservoirs were filled to capacity during the reporting period but averaged at maximum, 65 percent full. As of September 30, 1979, the amount of water in storage in all the reservoirs was 58 million cubic metres (47 thousand acre-feet) or 37 percent less than at the end of the preceding year.

With rainfall in 1978-79 below average, the Santa Clara Valley Groundwater subbasin experienced a decrease in the volume of water in storage and the Coyote and Llagas Groundwater Subbasins storage remained approximately the same. As water levels rise and fall, the volume in storage changes. This change of stored water in the unconfined zone can be estimated by multiplying estimates of the storage capacity for the aquifer materials by the area and by the change in depth between groundwater levels at the beginning and end of the season. This year, water in storage in the Santa Clara Valley Groundwater Subbasin decreased by 22 million cubic metres (18 thousand acre-feet). In the Coyote Subbasin, the volume of water in storage remained unchanged and in the Llagas Subbasin the change of volume of water in storage increased by two million cubic metres (two thousand acre-feet).

These estimates were checked by balancing the hydrologic components of water supply and utilization. Water supply consists of precipitation, stream inflow, imported water, and subsurface inflow. Water is utilized or lost by consumptive use, sewage export, stream outflow, and subsurface outflow. The difference between supply and utilization is the net surplus or deficit of water in storage in the groundwater reservoirs at the end of the season. The hydrologic balance, illustrated in Figure 1, shows a



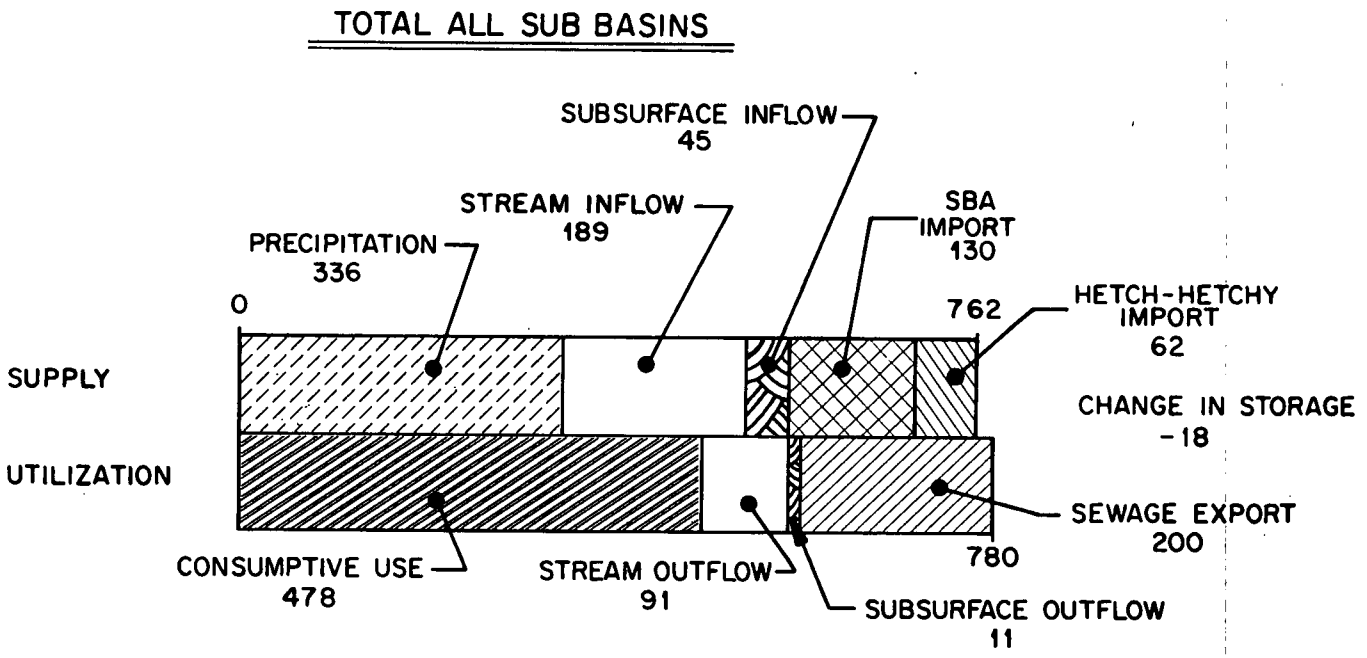
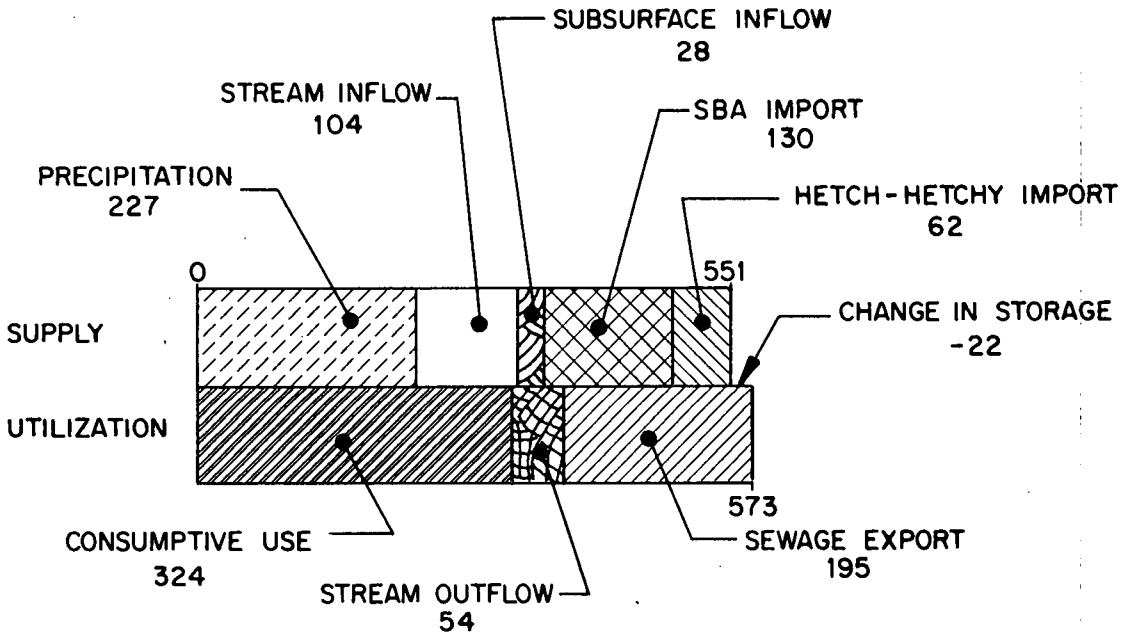
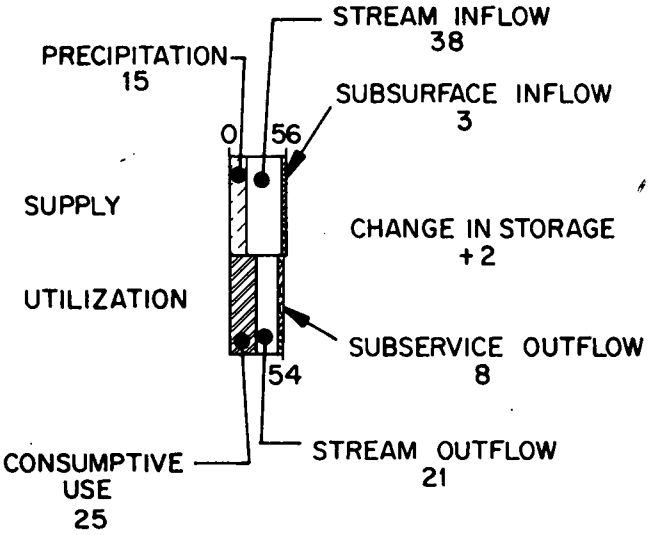


FIGURE 1-A HYDROLOGIC BALANCE OF GROUNDWATER 1977-78
(Values in million cubic metres)
One million cubic metres = 811 acre feet

SANTA CLARA VALLEY G.W. SUB BASIN



COYOTE G.W. SUB BASIN



LLAGAS G.W. SUB BASIN

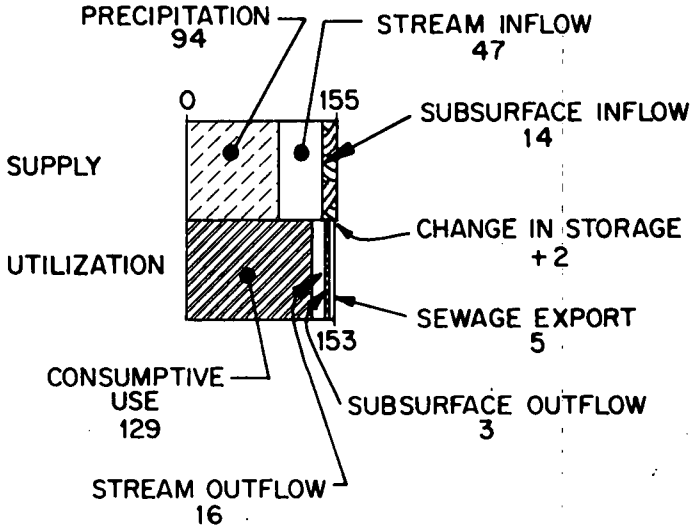


FIGURE 1-B HYDROLOGIC BALANCE OF GROUNDWATER 1977-78

(Values in million cubic metres)

One million cubic metres = 811 acre feet

decrease in the Santa Clara Valley Subbasin of 22 million cubic metres (18,000 acre-feet), an increase in the Coyote Subbasin of two million cubic metres (two thousand acre-feet), and an increase in the Llagas Subbasin of two million cubic metres (two thousand acre-feet. These compare favorably to the previously obtained decrease of 22 million, no change, and an increase of two million cubic metres for the Santa Clara Valley, Coyote and Llagas Subbasins respectively calculated using changes in groundwater elevation.

The discrepancy observed between the storage changes obtained as a net balance of hydrologic components and that obtained as a product of change in water levels and storage capacity is the result of uncertainties involved in estimates of subsurface inflows, consumptive use, and the storage coefficient of aquifers. However, the results are well within the accuracy acceptable for this kind of computation.

Shown on Figure 2 is the historical total amount of water supply available from local and imported sources and the total amount of water use for the period 1965 through 1979 in the Santa Clara Valley Subbasin area, and rainfall data for the same period.

Local water sources include groundwater produced in the Santa Clara Valley Groundwater Subbasin and surface water deliveries including San Jose Water Works diversions. The groundwater production does not include the amount of SBA water used for groundwater recharge which was 47 million cubic metres. The imported water deliveries consist of San Francisco Water Department water delivered through Hetch-Hetchy Aqueduct which started deliveries in 1952 and deliveries from the State Water Project through the South Bay Aqueduct which started in June 1965.

Actual water production in Santa Clara Valley Subbasin for the period 1970 through 1979 from all sources of supply is summarized in Table 1. Total supply and use for 1978-79 is illustrated in Figure 3.

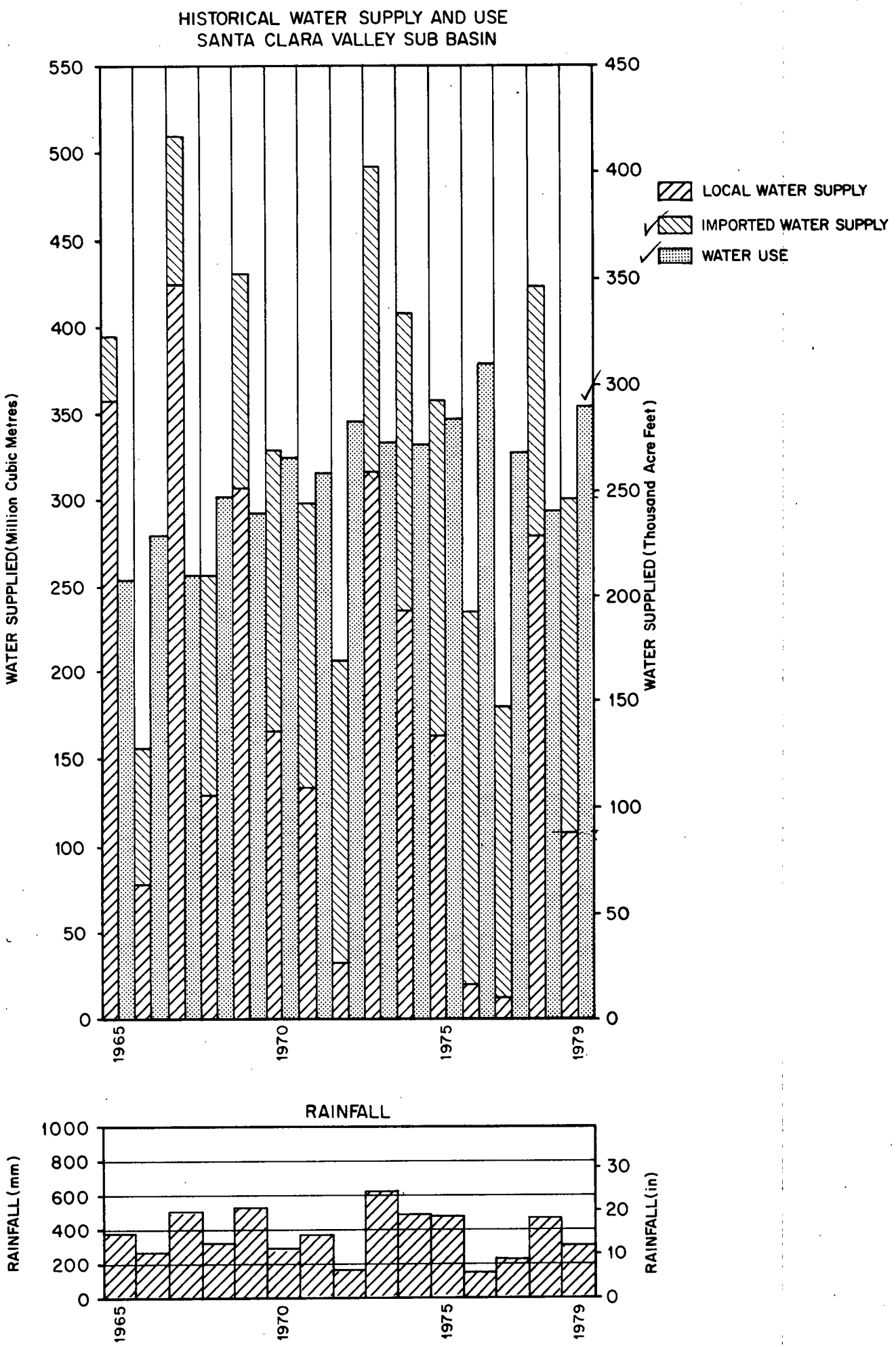

HISTORICAL WATER SUPPLY AND USE
SANTA CLARA VALLEY SUB BASIN
LOCAL WATER SUPPLY
IMPORTED WATER SUPPLY
WATER USE
WATER SUPPLIED (Million Cubic Metres)
WATER SUPPLIED (Thousand Acre Feet)
0
50
100
150
200
250
300
350
400
450
500
550
0
50
100
150
200
250
300
350
400
450
1965
1970
1975
1979
RAINFALL
RAINFALL (mm)
RAINFALL (in)
0
200
400
600
800
1000
0
10
20
30
1965
1970
1975
1979

FIGURE 2

TABLE 1

WATER USE SUMMARY

SANTA CLARA VALLEY GROUNDWATER SUB BASIN

(Values in million cubic metres)

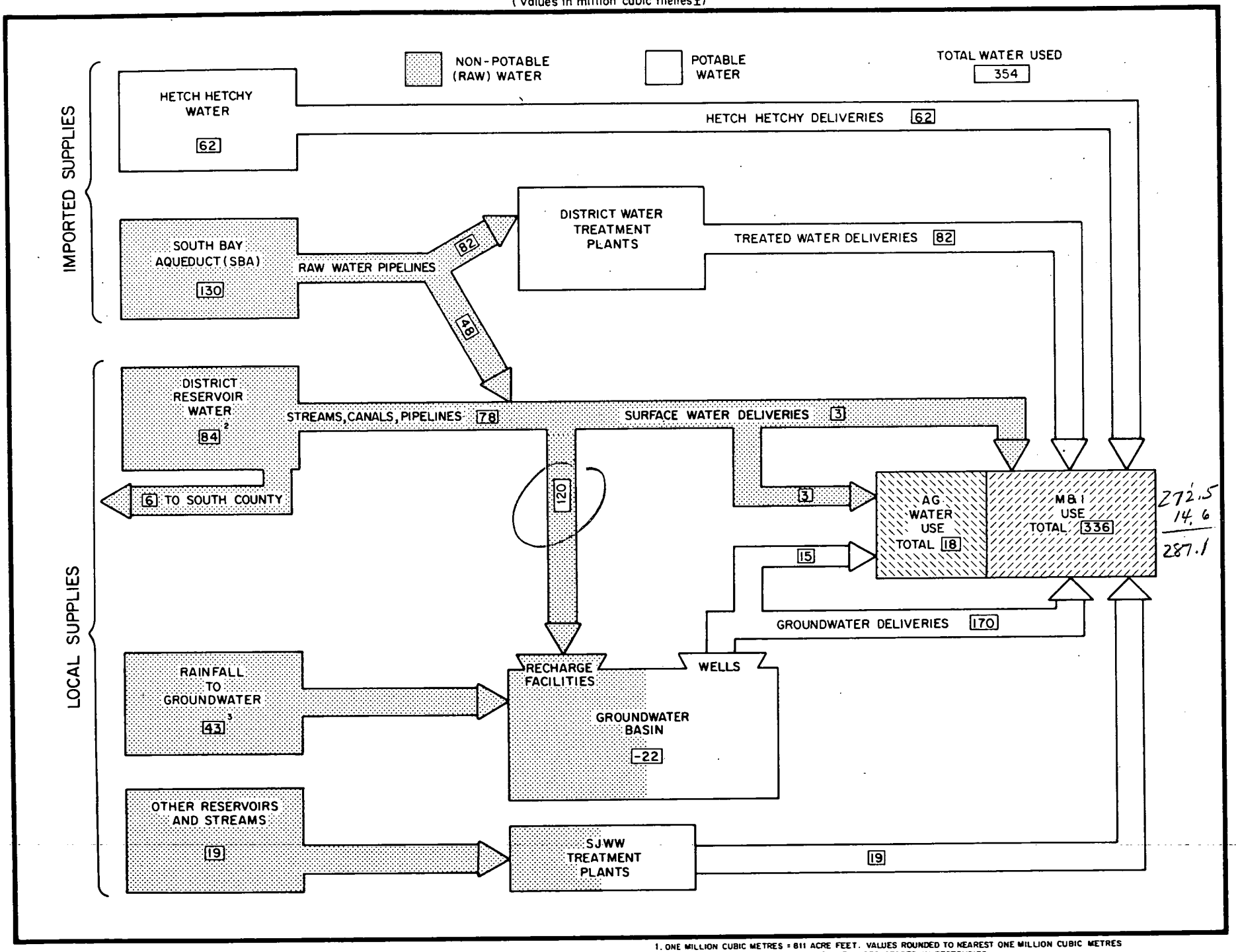
Fiscal Year	Surface Water Ag	Surface Water Non-Ag	Groundwater Ag	Groundwater Non-Ag	Distribution of SBA Import** Treated	Distribution of SBA Import** Untreated	Hetch Hetchy	SJWW Diversion	Total
69-70	6.0	1.0	36.1	154.3	48.3	0.6	59.6	19.5	325.4
70-71	5.4	1.4	29.2	153.3	54.3	0.9	55.7	15.9	316.1
71-72	5.9	1.9	29.6	175.3	60.2	1.0	61.5	10.9	346.3
72-73	5.2	2.0	21.6	169.9	55.5	0.7	60.3	18.0	333.2
73-74	3.7	2.2	19.6	159.1	56.1	0.7	64.4	25.7	331.5
74-75	4.3	2.3	20.8	148.5	83.1	0.7	65.8	21.6	347.1
75-76	6.2	2.5	24.7	183.1	81.5	1.0	70.0	10.5	379.5
76-77	3.1	1.9	20.6	167.8	74.5	0.9	58.8	0.9	328.5
77-78	3.0	1.9	14.4	142.3	73.4	1.0	46.0	12.3	294.3
78-79	3.1	2.4	14.8	169.8	82.3	0.8	62.4	19.1	354.7

* One million cubic metres = 811 acre-feet.

** Imported SBA Water recharged to the groundwater basin included in groundwater used (47 million cubic metres).

WATER SUPPLY AND USE

Santa Clara Valley Groundwater Sub Basin
(Values in million cubic metres ±)



1. ONE MILLION CUBIC METRES = 811 ACRE FEET. VALUES ROUNDED TO NEAREST ONE MILLION CUBIC METRES
2. INCLUDES 32 MILLION CUBIC METRES OF WATER STORED IN RESERVOIRS.
3. INCLUDES UNMEASUREABLE SUBSURFACE INFLOW.

FIGURE 3

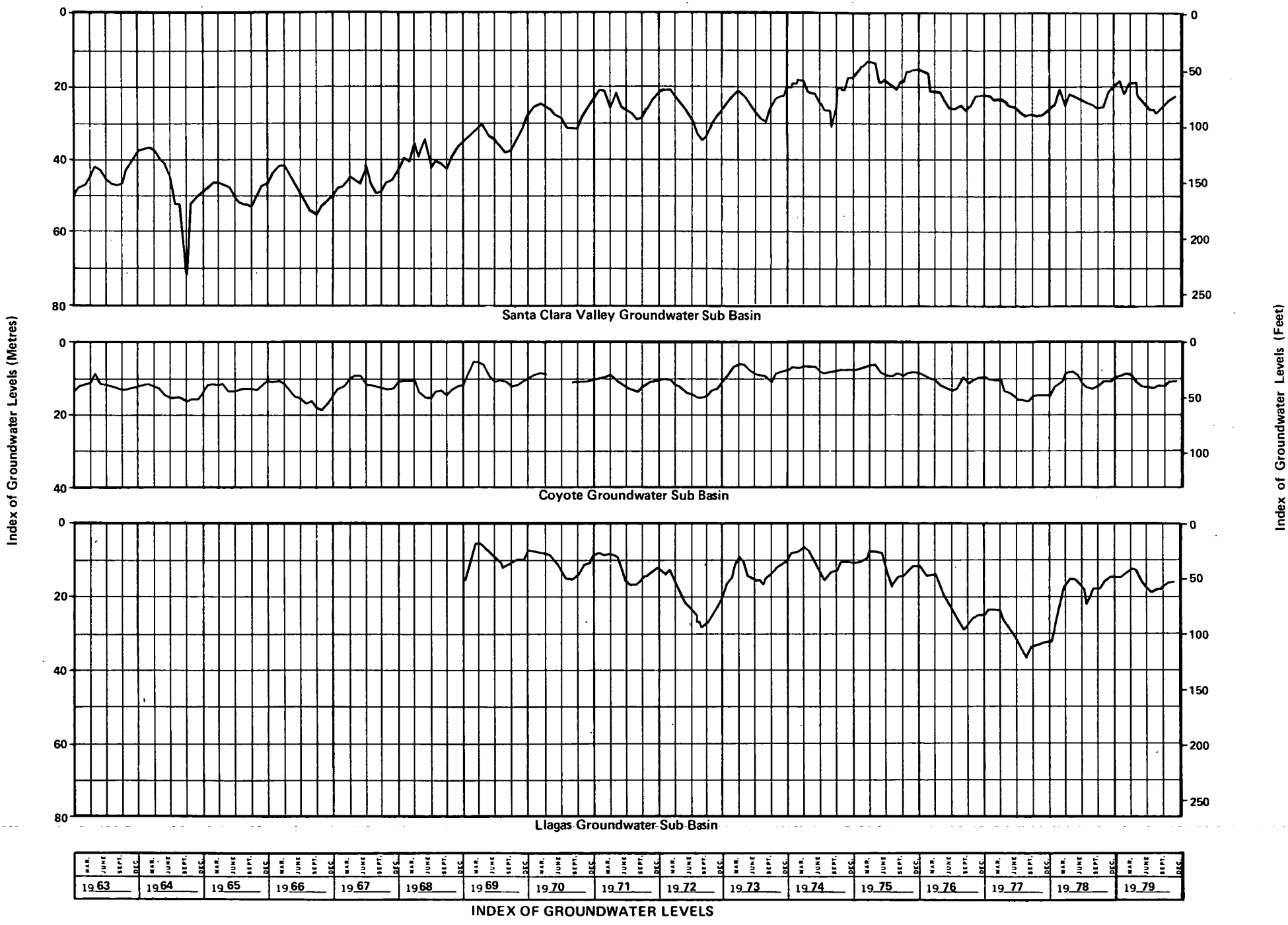
IV. GROUNDWATER

A. Groundwater Levels

A groundwater contour map, showing lines of equal elevation of water levels in wells as of September 1, 1979 (traditionally the seasonal low) is shown on Plate 2. Plate 3 shows lines of equal change in elevation of water in wells between September 1978 and September 1979. Plate 4 shows lines of equal depth to water as of September 1, 1979. These groundwater contours are based on information from more than 352 wells.

The change in groundwater storage is obtained by use of Plate 3, Map of Equal Change in groundwater levels. Groundwater levels (determined from the unconfined area of the groundwater contour map) for the Santa Clara Valley Subbasin show a decrease of 1.2 metres (4 feet) from 1978 levels, the Coyote Subbasin show virtually no variation and the Llagas Subbasin an increase of 0.3 metres (one foot).

An index of the monthly fluctuation of water levels from 1963 to 1979 in the Santa Clara Valley, Coyote, and Llagas Subbasins is presented in Figure 4. Well Nos. 07S01E07R99 and 10S03E13D03 are the well hydrographs used to represent trends in the Santa Clara Valley and Llagas Groundwater Subbasins, respectively. The Coyote Subbasin is represented on Figure 4 by the weighted average depths to water in four representative wells, which are monitored at the beginning of each month. These weighted averages are indexes and as such do not represent the actual depth to water at any point within this basin. The intent of Figure 4 is to show trends in the change of groundwater levels in the subbasins over the years.


Index of Groundwater Levels (Metres)
Index of Groundwater Levels (Feet)
Santa Clara Valley Groundwater Sub Basin
Coyote Groundwater Sub Basin
Llagas Groundwater Sub Basin
0
20
40
60
80
0
50
100
150
200
250
MAR.
JUNE
SEPT.
DEC.
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
INDEX OF GROUNDWATER LEVELS

B. Groundwater Recharge

The District, as part of its ongoing water management program, recharges the Santa Clara Valley, Coyote, and Llagas Groundwater Subbasins with local and imported water.

In 1978-79, 93 million cubic metres (75,000 acre-feet) of water were recharged in the Santa Clara Valley Subbasin, which is an 11 percent decrease over the 105 million cubic metres (85,000 acre-feet) recharged in 1977-78. This was due to a below-average rainfall during the 1978-79 period. About 46 million cubic metres (37,000 acre-feet) of water were recharged from reservoir supplies and about 47 million cubic metres (38 thousand acre-feet) were recharged from imported South Bay Aqueduct water. Additionally, six million cubic metres (5,000 acre-feet) of water were recharged in the Coyote and Llagas Subbasins from Anderson Reservoir through the Main Avenue and Madrone Channel Recharge Facilities.

C. Land Surface Subsidence

Subsidence of the land surface occurs when intensive groundwater pumping results in lowered water pressures in the groundwater basin materials. This increases the effective overburden load on the clay materials in and separating aquifers. As a result, the clay materials compact with consequential sinking of the overlying land surface. From 1912 to 1969 (the year when significant subsidence stopped), the cumulative land subsidence, as measured by the National Oceanic and Atmospheric Administration (formerly U.S. Coast and Geodetic Survey) at the bench mark in San Jose, was four metres (13 feet). Since 1967, a precise level circuit has not been rerun to all bench marks throughout the areas of subsidence. However, the District established a single level circuit around the south end of San Francisco Bay that was run annually from 1963 to 1976. This line of levels has not been run since 1976 because the amount of land surface subsidence was less than the accuracy of the leveling.

In 1960, the U.S. Geological Survey installed extensometers (compaction recorders) in 305 metre (1,000 feet) cased core holes at the centers of subsidence, one in San Jose and another in Sunnyvale. These extensometers have recorded compaction of the confined aquifer system for 19 years.

Records from these instruments show that the compaction measured to a depth of 305 metres is about equal to the land surface subsidence as measured periodically by leveling of the bench marks.

According to Poland, "The subsidence in the Santa Clara Valley of California has been stopped by raising the artesian head in the aquifers until it equaled or exceeded the maximum pore pressures in the aquitards. The compaction and water-level records being obtained by the Geological Survey indicate that if the artesian head can be maintained 10 to 20 feet above the levels of 1971-73, subsidence will not recur. On the other hand, subsidence will recommence if the artesian head is drawn down as much as 20 to 30 feet below the 1971-73, levels."[1/] At the Santa Clara Valley Subbasin index well this level is 45 metres (140 feet) below the ground surface.

Land surface subsidence has cost Santa Clara County residents millions of dollars because of its effect on flood control channels, bayfront levees, wells, sanitary sewer lines and other underground utilities.

The District has been working toward the goal of obtaining water supplies adequate to maintain groundwater levels and prevent overdraft of the basin. As a result of increased imported water supplies and generally average rainfall, artificial recharge and decreased pumping, groundwater levels have generally recovered since 1967.

1/ Poland, Joseph F., "Land Subsidence in Santa Clara Valley, California", Water Spectrum, Department of the Army, Spring 1978, Vol. 10, No. 2.

D. Groundwater Quality

1. General

Groundwater pumped from most of the existing wells in the County is of good quality and, in general, meets drinking water standards. Groundwaters from properly constructed and protected wells, including many municipal well fields, are generally used directly without chlorination.

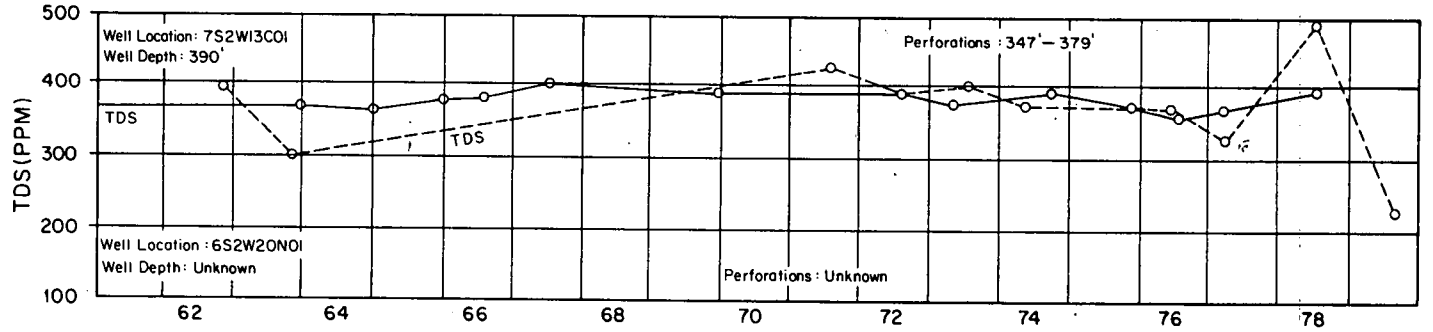
Graphical representations of some significant water quality parameters at selected wells are shown in Figure 5. The locations of these wells are shown on Plate 1. Generally, the pumped water may be classified as moderately to extremely hard. Hardness of water is caused principally by some compounds of calcium and magnesium.

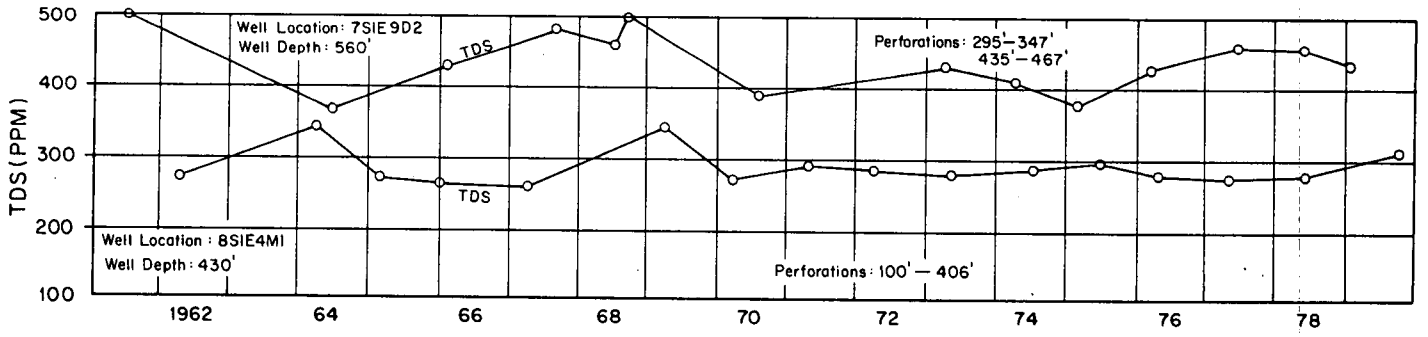
Certain localized areas have yielded groundwater of poor quality as a result of contamination from surface waters or degradation from subsurface sources. In the summer of 1978 the Department of Water Resources found high levels of nitrates in the San Martin area, confirming earlier findings of the Central Coast Water Quality Control Board. A special water quality study in the San Martin area will begin in 1980.

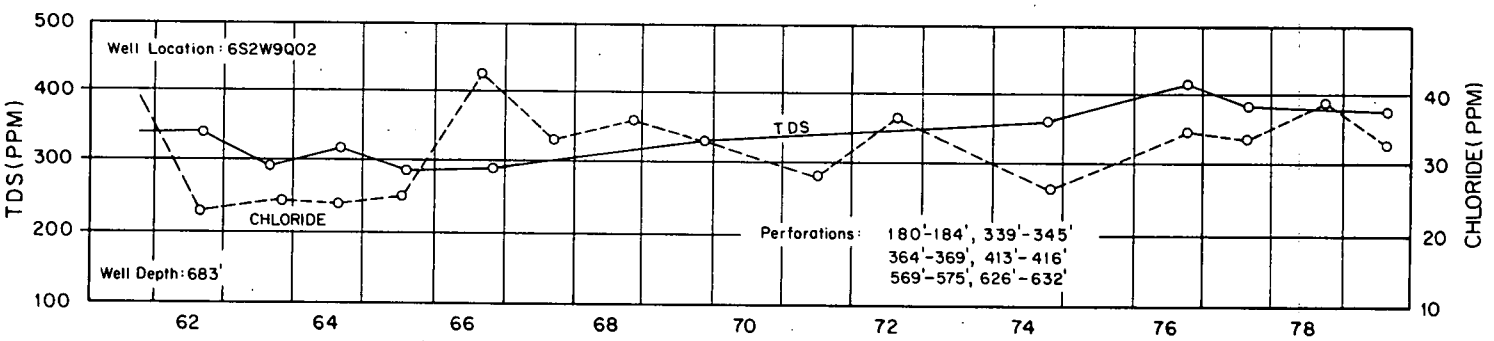
Another area of groundwater degradation is in the Santa Cruz Mountains above Lexington Reservoir where the Santa Clara County Health Department has obtained samples of water from domestic wells that does not meet drinking water standards. This situation, probably caused by improper disposal of sanitary sewage, will also be the subject of a special study. The principal sources of contamination are septic tanks, surface ponding of contaminants and pollutants, fertilizers, and questionable waste disposal practices. From subsurface sources, the threat of degradation comes from saltwater intrusion from San Francisco Bay (Plate 5) or from mineralized connate waters found at depth.

Another factor which may contribute to the degradation of the groundwater is the method of well construction. Properly constructed wells eliminate the possibility of the well functioning as a conduit for the movement of water between contaminated (or

GROUNDWATER QUALITY VARIATIONS IN SELECTED WELLS







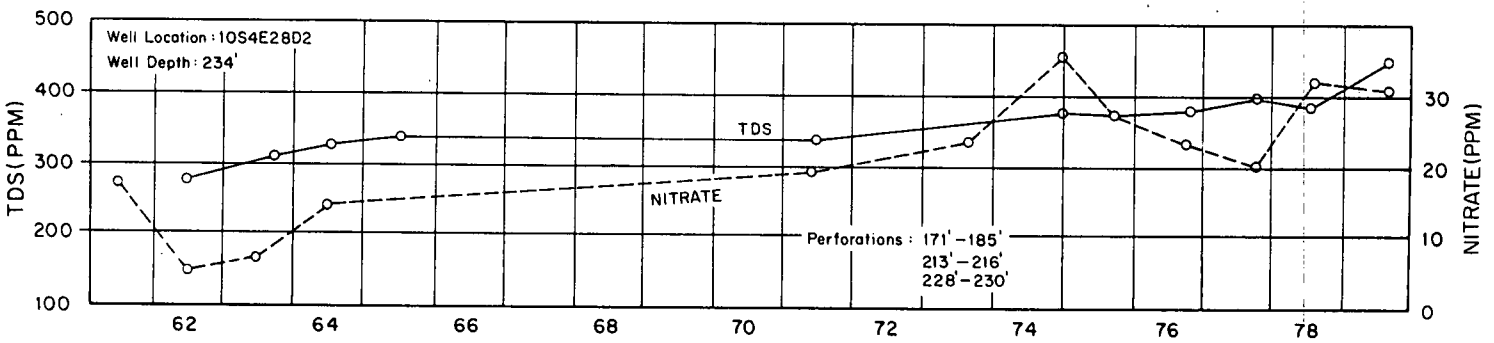


FIGURE 5

degraded) and uncontaminated aquifers and also prevent contamination from surface sources. Improper methods of well construction and destruction, if allowed, could contribute to the deterioration of freshwater aquifers. Once an aquifer becomes contaminated or degraded, its restoration is extremely difficult and expensive. In order to help prevent degradation of the groundwater in Santa Clara County, the District has adopted well construction and destruction standards (SCVWD Ordinance No. 75-6). The purpose of these standards is to protect and preserve the groundwater supply for future uses.

To aid in the management and protection of the quality of all the waters in the valley, the District is monitoring the quality of waters in the underground subbasins, streams, and the surface reservoirs.

2. Saltwater Intrusion

Saltwater intrusion is characterized by movement of saline waters from whatever sources into freshwater aquifers. Saltwater intrusion in one form or another has long been recognized to have occurred in aquifers along the Baylands area bordering South San Francisco Bay in Santa Clara County. Intrusion of saltwater into and contamination of an aquifer degrades the water quality of aquifers for most beneficial uses and, when severe, can render it virtually unusable. Recognizing the potential for future problems, the District has studied saltwater intrusion in the San Francisco Bayfront area to assess existing conditions, to determine possible mechanisms of intrusion, and to evaluate possible actions that might be required to prevent or minimize any futher intrusion. The conclusions of this study are summarized below.

The upper aquifers (less than 150 feet deep) fringing San Francisco Bay are widely intruded as shown on Plate 5. Uncontaminated groundwater normally contains chloride at concentrations less than 50 mg/l. When groundwater contains chloride concentrations of 100 mg/l it is considered a definite early sign of saltwater intrusion. It is, however, recognized that the actual threshold between nonaffected and saltwater intruded water is somewhat less than 100 mg/l.

In the 1960s, when the groundwater basin was heavily stressed by heavy groundwater pumping, slightly more area was intruded than today. A local area of very high salt concentrations in the upper aquifer zone has been discovered in the Palo Alto Bayfront area. As the concentrations are much higher than found in normal seawater, it is speculated that the deteriorated waters are entrapped connate water that had undergone a process of concentration (by evaporation) in the geologic past.

In other areas, intrusion of the upper aquifer zone may be the classical case of intrusion whereby saltwater displaces fresh water. This displacement has progressed a short distance inland from the Bayfront, estuaries or salt ponds. This intruding front is preceded by a large aureole or transition zone of mixed water. The mixed transition

zone appears to be much larger than would normally accompany a classical front. As noted on Plate 5, the greatest inland incursion of the mixed transition zone occurs along Guadalupe River and Coyote Creek, implying a relationship between intrusion and saltwater incurring inland along the stream channels. It is along these channels that the greatest abundance of shallow aquifers exists (and, conversely, where the thinnest clay cap near the surface occurs). Land surface subsidence has aggravated the condition of intrusion by further creating unfavorable hydraulic gradients, allowing inland incursion of saltwaters further up channels.

In the lower aquifer zone (below 150 to 200 feet), which constitutes the principal pumping zone, intrusion is relatively mild and encompasses a much smaller area. Over the years, small areas within the lower aquifer zone have shown higher than normal salt concentations. Most of the contaminated lower aquifers lie beneath the intruded portion of the upper aquifer zone. The areal distribution and the exhibited variability of water quality (salt content) with time imply that the intrusion into the lower aquifer zone is from the intruded upper zone through local connections allowing interaquifer transfer to the lower zone. Connections are provided by abandonded and improperly sealed or improperly constructed wells.

The present extent of saltwater intrusion can change depending upon the future operation of the groundwater basin and demand for groundwater in the area. In order to monitor the status of intrusion, the District maintains a salinity monitoring program which involves about 75 wells in the upper and lower aquifers.

In the Palo Alto Bayfront area, the District is constructing a two-mile-long hydraulic barrier in order to prevent further intrusion and to reclaim portions of the already intruded aquifers. The overall project is discussed further in this report under "Water Reclamation".

V. SURFACE WATER

A. Precipitation

Rainfall is the source of all locally developed water supplies. The long-term precipitation at San Jose is illustrated in Figure 6 as the accumulated departure from the mean which denotes graphically the wet and dry periods of rainfall. The important feature in Figure 6 is the slope of the line; particularly whether it is positive (up) or negative (down). Each point is plotted as a difference from the long-term average; a wet year showing a positive difference and a dry or below normal rainfall year indicating a negative difference. If each difference is added to that of the previous year, a trend of positive or negative increments becomes apparent. An upward trend would, therefore, indicate a period of years which have received above normal rainfall and a downward trend would be indicative of a below normal period.

The accumulated departure from the mean is used to identify long-term wet and dry periods. Despite short term fluctuations, the long-term periods are easily discernible.

Beginning in 1875, rainfall approximated the long-term average until 1890 when a series of wet years began which generally continued until about 1916. The valley experienced low rainfall for several years following 1920 until 1935. It was during this drought period that valley residents first initiated a comprehensive water conservation program. The completion of the valley's first five water supply reservoirs in 1935 coincided with the beginning of a short interval of above-average rainfall. This enhanced the water supply picture and enabled groundwater levels, which had been declining, to recover.

Between 1943 and 1962, another series of dry years occurred. From 1962 to 1975, the valley has had rainfall slightly above the long-term average. However, since 1975, except for 1977-78 rainfall has been below average.

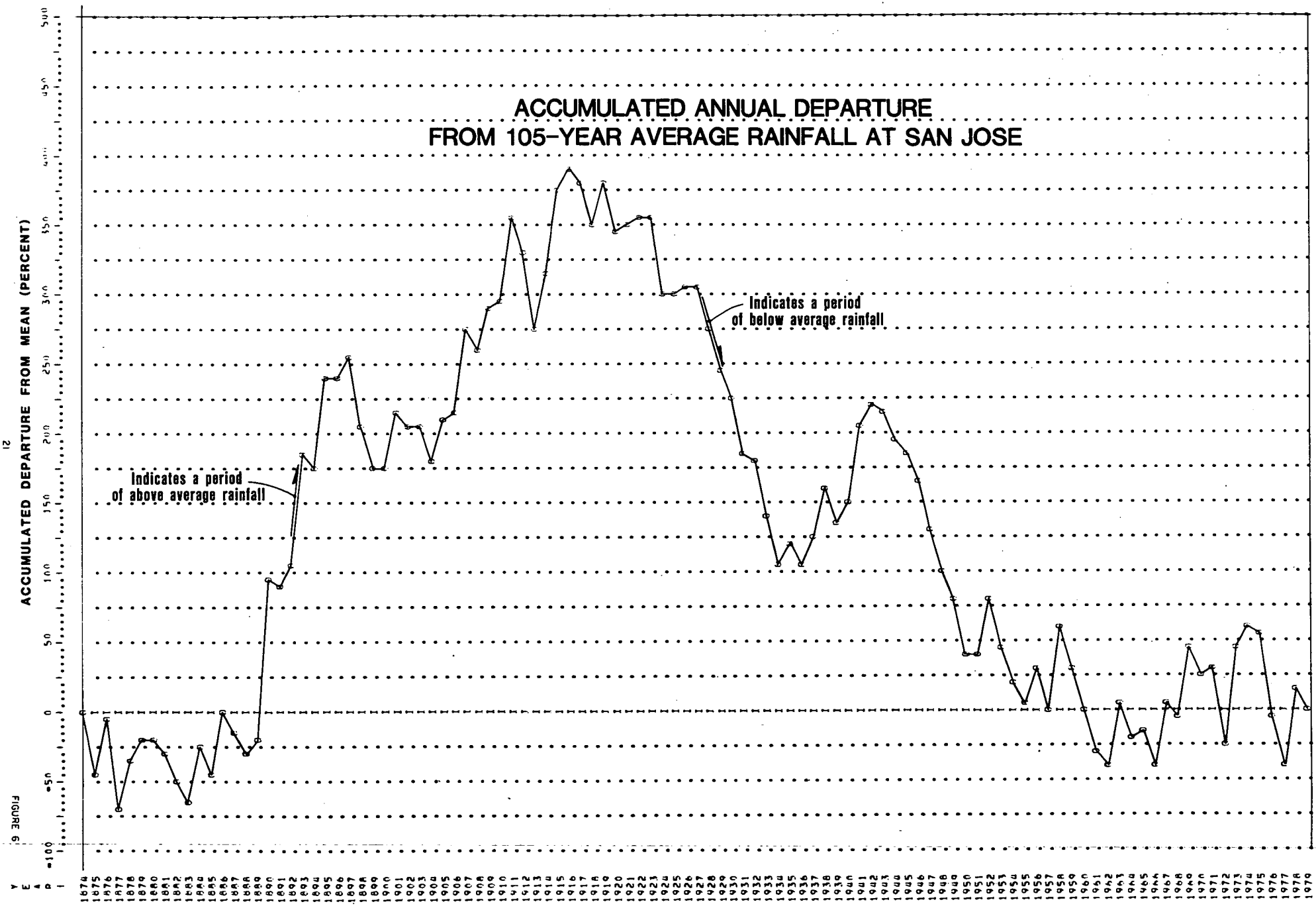

ACCUMULATED ANNUAL DEPARTURE
FROM 105-YEAR AVERAGE RAINFALL AT SAN JOSE
ACCUMULATED DEPARTURE FROM MEAN (PERCENT)
Indicates a period of above average rainfall
Indicates a period of below average rainfall
YEAR

FIGURE 6

The need for water and the amount of water available for supply are both very dependent on seasonal rainfall. In a below-normal rainfall year, when water supplies are low, the amount of municipal, industrial, and agricultural water use increases, while in a wet year, water use drops.

1. Weather Modification

In its search for additional means of increasing its water supply, the District has been conducting cloudseeding operations since December of 1951.

Under natural conditions only a small amount of the moisture passing over the valley in the form of clouds ever reaches the ground as rain or snow. The function of a cloudseeding program is to increase total precipitation by introducing artificial nuclei into the clouds at the proper time and location.

The basic conditions for successful operation of the District's weather modification program occur when moisture-laden air masses from the Pacific Ocean are driven over the Santa Cruz Mountains by the westerly and southwesterly winds that prevail during storms. As these air masses approach the mountains, they are forced to rise abruptly, producing turbulence and rapid vertical velocities. When cloud droplets rapidly rise to altitudes above the freezing level, they form into ice crystals on dust, hydrocarbon particles, and other substances. When these ice crystals fall to an elevation where the temperature is above the freezing point, they melt, thereby forming raindrops which continue to collect moisture and grow larger as they fall to earth.

Minute crystals of silver iodide (Ag I) also act as nucleating agents and are effective at higher temperatures than natural nuclei. One gram of silver iodide produces millions of nuclei.

Ground-based generators located to the west and south of the main watersheds are used to produce the nuclei which are carried aloft by the rising air currents passing over the mountains.

Not all storms are suitable for seeding. Much information about the storm is needed before a decision to seed can be made. The operation is controlled from the District's Weather Center located on a low hill near the center of the Santa Clara Valley at an elevation of 140 metres (450 feet) above sea level. The Weather Center houses weather radar, radio, and equipment for receiving meteorological data.

Prior to any seeding, a determination is made relative to reservoir storage, anticipated rainfall intensity and runoff, and, if any chance of flooding is possible, seeding is not conducted. Depending on conditions, the generator operators, who live in the area where a generator is located, are called from the Weather Center and instructed to turn the generators on or off.

In years of low total rainfall, such as 1976-77, cloudseeding apparently has little beneficial effect. This is to be expected considering the basic theory of cloudseeding; cloudseeding is a rain-increasing and not a rain-making process. During dry years, few, if any, opportunities exist for seeding.

An increase in seasonal rainfall has been indicated to range between 10 percent and 15 percent for those years when cloudseeding was conducted.

In the 1978-79 season, nine storms were seeded between November 1978 and March 1979 with a total of 417 generator-hours for the period and the use of 10,429 grams of silver iodide.

B. Imported Water

The existing and proposed water import conveyance, treatment and distribution system for Santa Clara Valley is shown in Figure 7.

1. South Bay Aqueduct

The primary source of imported water for Santa Clara County is the South Bay Aqueduct. In 1978-79, 130 million cubic metres (106 thousand acre-feet) of water was delivered into Santa Clara County through this facility. Of this total, 59 million cubic metres (48 thousand acre-feet) was treated at the Rinconada Water Treatment Plant and

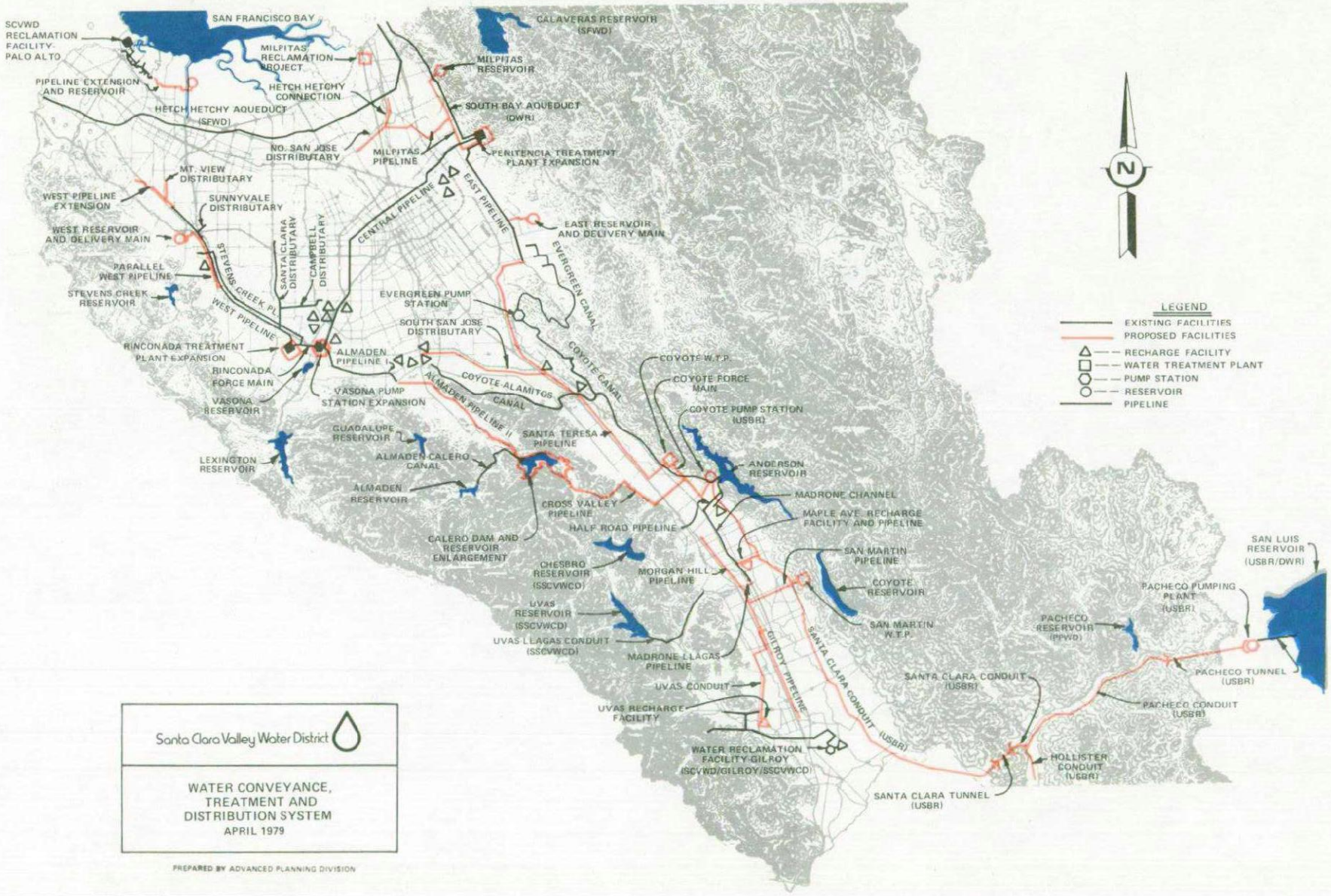

SAN FRANCISCO BAY
SCVWD RECLAMATION FACILITY-PALO ALTO
PIPELINE EXTENSION AND RESERVOIR
MILPITAS RECLAMATION PROJECT
HETCH HETCHY CONNECTION
HETCH HETCHY AQUEDUCT (SFWD)
CALAVERAS RESERVOIR (SFWD)
MILPITAS RESERVOIR
SOUTH BAY AQUEDUCT (DWR)
PERITENCIA TREATMENT PLANT EXPANSION
NO. SAN JOSE DISTRIBUTARY
MILPITAS PIPELINE
MT. VIEW DISTRIBUTARY
WEST PIPELINE EXTENSION
SUNNYVALE DISTRIBUTARY
WEST RESERVOIR AND DELIVERY MAIN
PARALLEL WEST PIPELINE
STEVENS CREEK RESERVOIR
STEVENS CREEK PL
WEST PIPELINE
SANTA CLARA DISTRIBUTARY
CAMPBELL DISTRIBUTARY
CENTRAL PIPELINE
EAST PIPELINE
EAST RESERVOIR AND DELIVERY MAIN
EVERGREEN CANAL
EVERGREEN PUMP STATION
SOUTH SAN JOSE DISTRIBUTARY
COYOTE CANAL
RINCONADA TREATMENT PLANT EXPANSION
RINCONADA FORCE MAIN
ALMADEN PIPELINE I
VASONA RESERVOIR
VASONA PUMP STATION EXPANSION
COYOTE-ALAMITOS CANAL
ALMADEN PIPELINE II
COYOTE W.T.P.
COYOTE FORCE MAIN
COYOTE PUMP STATION (USBR)
GUADALUPE RESERVOIR
SANTA TERESA PIPELINE
LEXINGTON RESERVOIR
ALMADEN-CALERO CANAL
ALMADEN RESERVOIR
ANDERSON RESERVOIR
MADRONE CHANNEL
CROSS VALLEY PIPELINE
MAPLE AVE. RECHARGE FACILITY AND PIPELINE
HALF ROAD PIPELINE
CALERO DAM AND RESERVOIR ENLARGEMENT
SAN MARTIN PIPELINE
CHESBRO RESERVOIR (SSCVWCD)
MORGAN HILL PIPELINE
COYOTE RESERVOIR
UVAS RESERVOIR (SSCVWCD)
SAN MARTIN W.T.P.
UVAS-LLAGAS CONDUIT (SSCVWCD)
MADRONE-LLAGAS PIPELINE
GILROY PIPELINE
SANTA CLARA CONDUIT (USBR)
UVAS CONDUIT
UVAS RECHARGE FACILITY
WATER RECLAMATION FACILITY-GILROY (SCVWD/GILROY/SSCVWCD)
SANTA CLARA TUNNEL (USBR)
SANTA CLARA CONDUIT (USBR)
HOLLISTER CONDUIT (USBR)
PACHECO CONDUIT (USBR)
PACHECO TUNNEL (USBR)
PACHECO RESERVOIR (PPWD)
PACHECO PUMPING PLANT (USBR)
SAN LUIS RESERVOIR (USBR/DWR)
N
LEGEND
EXISTING FACILITIES
PROPOSED FACILITIES
RECHARGE FACILITY
WATER TREATMENT PLANT
PUMP STATION
RESERVOIR
PIPELINE
Santa Clara Valley Water District
WATER CONVEYANCE, TREATMENT AND DISTRIBUTION SYSTEM
APRIL 1979
PREPARED BY ADVANCED PLANNING DIVISION

Figure 7

23 million cubic metres (19 thousand acre-feet) was treated at the Penitencia Water Treatment Plant for delivery to consumers through retail water agencies. In addition, one million cubic metres (700 acre-feet) of raw water was delivered directly from District pipelines for use by individual contractors. The remaining 47 million cubic metres (38 thousand acre-feet) was recharged into the underground water supply through the District's recharge facilities.

2. Hetch Hetchy

San Francisco Water Department's Hetch Hetchy Aqueduct provides a second source of imported water. During the fiscal year 1978-79, this system delivered 62 million cubic metres (51 thousand acre-feet) directly to the water supply systems of the Cities of Milpitas, San Jose, Sunnyvale, Santa Clara, Mountain View, and Palo Alto and to the Purissima Hills County Water District. Small amounts of this water were also delivered to Stanford University, NASA, Moffett Field, Agnews State Hospital, and other local contractors.

3. San Felipe Project Status

As of September 30, 1979, excavation on the 8.6-kilometre (5.3-mile) section of the Pacheco Tunnel of the San Felipe Division facilities was about 30 percent completed. The next major features scheduled for construction are the 1.7-kilometre (1.0-mile) Santa Clara Tunnel and a 2.6-kilometre (1.6-mile) section of the Hollister Conduit. Bids for construction of these facilities are scheduled to be advertised in June 1980. This schedule is, however, contingent upon continued appropriation of adequate federal funds. Initial delivery of water to Santa Clara County is scheduled for 1987.

Concomitant with the work of the Water and Power Resources Service (formerly the Bureau of Reclamation), the District is proceeding with the design of the Almaden Valley II and Cross Valley Pipelines (shown in Figure 7), which will distribute San Felipe and local water in Santa Clara County.

C. Water Conservation

The term "Water Conservation", as used in this report, refers to programs to manage and make the best use of water available to the District from all sources. "Water Savings" refers to efforts to reduce water use, a part of any water conservation program, and is discussed later in this section of this report.

The District's water conservation program, an integral part of its overall water management activities, includes local water storage facilities, wastewater reclamation, and water savings programs.

1. Local Storage Reservoirs

The District has constructed storage reservoirs on most of the major streams to retain seasonal runoff which later is released for groundwater recharge and direct surface irrigation. The District owns and operates eight dams and reservoirs with a combined capacity of about 190 million cubic metres (155,000 acre-feet). Other public agencies in the County have constructed additional reservoirs with a total storage capacity of about 30 million cubic metres (24,000 acre-feet). Another significant storage reservoir is Lake Elsman with a capacity of about nine million cubic metres (7,500 acre-feet).

Table 2 shows the capacity and percent full of all the reservoirs on October 1, 1978 and on September 30, 1979. The total amount of water stored in all reservoirs at the end of the water year was a small fraction of the total capacity. In September 30, 1979, the total amount of water stored in all these reservoirs was 38 million cubic metres less than in October 1, 1978. Of these 38 million cubic metres, five million cubic metres correspond to the decrease in storage in South Santa Clara Valley Water Conservation District reservoirs.

TABLE 2

RESERVOIR STORAGE

Reservoir	Capacity: Million Cubic Metres	Capacity: Acre-Feet	Percent Full: Oct. 1, 1978	Percent Full: Sept. 30, 1979	
Almaden	2.2	1,800	18.4	12.9	
Anderson	112.6	91,300	43.3	23.4	
Calero	12.5	10,200	53.0	22.4	
Chesbro*	10.0	8,100	44.5	18.0	-2146
Coyote	29.2	23,700	70.2	59.6	
Guadalupe	4.6	3,700	19.8	8.5	
Lexington	24.9	20,200	29.4	23.8	
Pacheco	7.6	6,100	8.9	3.3	
Stevens Creek	4.4	3,600	11.7	5.1	
Uvas*	12.3	10,000	39.4	21.5	-1790
Vasona	0.5	400	82.6	87.0	

*South Santa Clara Valley Water Conservation District's Reservoirs

2. Water Reclamation

In its search for new sources of water, the District, as early as 1958, engaged a private consultant to explore methods of reclamation of sewage and industrial wastewater. An oxidation pond was constructed adjacent to the San Jose Water Pollution Control Plant. Tests were conducted over a two-year period yielding valuable information for future efforts.

Presently, two water reclamation plants are in operation and other studies are being conducted as described below.

2.1 Water Reclamation Facility, Palo Alto

Operation of the Palo Alto Reclamation Facility began in June 1977. This facility can produce high-quality water at a rate of four million gallons daily by providing advanced wastewater treatment to effluent discharged from the adjacent Regional Water

Quality Control Plant. The Regional Plant, which provides secondary treatment plus nitrification and filtration, is operated by the Cities of Palo Alto, Mountain View, and Los Altos in conjunction with the East Palo Alto Sanitary District, Stanford University, and the Town of Los Altos Hills. The Reclamation Facility, operated by the Santa Clara Valley Water District provides split treatment. Up to two million gallons per day of water receive complete advanced water treatment. The remaining two million gallons per day receive only filtration and disinfection.

The primary use of the water reclaimed at the Palo Alto Facility is to enhance the quality of water in a shallow groundwater basin south of the plant by providing a barrier to the intrusion of saline Bay water into the basin. This objective will be achieved by pumping water into the aquifer through a series of wells which form a line roughly parallel to the shore of San Francisco Bay in that area. Part of the water pumped into the basin will move towards the Bay, sweeping the salt water in the basin before it and preventing any more salt water from entering the basin beyond the line of injection wells. A second line of wells has been built about 1,000 feet inland from the first line. These wells will be used to extract water from the groundwater basin to keep the hydraulic gradient down, prevent waterlogging and prevent reclaimed water from reaching aquifers used for drinking water supplies. The extracted water will contain the reclaimed water that did not flow bayward, plus some local groundwater. Initially this extracted groundwater will be saline, but, as the basin is flushed, the groundwater will come to have better quality. Once the groundwater quality has improved, the extracted water can be reused further.

Up to one million gallons per day of water is currently provided at nominal cost for irrigating Palo Alto's Municipal Golf Course. However, during 1978-79 only about one-fourth of this amount was actually used. In the future, the remaining three mgd of water may be used for industrial purposes in Mountain View, at the National Aeronautics and Space Administration's Ames Research Center and for irrigation at the City of Mountain View Shoreline Park.

2.2 Water Reclamation Facility, Gilroy

The wastewater reclamation facility in Gilroy was constructed under an emergency program to combat the severe overdraft of a limited underground reservoir and meet the need for new water supplies in the Gilroy area during the drought.

The facility was constructed jointly by the Santa Clara Valley Water District, the City of Gilroy, and the South Santa Clara Valley Water Conservation District.

The treatment system takes primary effluent from the City of Gilroy plant and provides secondary treatment in an oxidation pond. The detention time in the oxidation pond, which has eight floating aerators, is 12 to 18 days. After the oxidation pond, the treated water passes through mechanical strainers and is chlorinated.

The distribution system includes 18 kilometres (eight miles) of 12-inch steel pressure pipe. An existing 150,000 cubic metres (120 acre-feet) reservoir is used for terminal storage.

The recycled water is used for irrigation of agriculture and will be used for landscape irrigation. The agricultural users grow primarily nursery crops, flowers, and seed crops. This market contains about 120 hectares (300 acres). The landscaping irrigation would be at the City golf course. This market contains about 40 hectares (100 acres). During 1978-79, users contracted for 90,000 cubic metres (160 acre-feet).

2.3 Water Reclamation Study, North San Jose-Milpitas

The District, through consultants, completed a Project Report and Draft EIR in July 1978 examining the feasibility of using reclaimed water in the areas of Milpitas, North San Jose, and North Santa Clara. The findings of this study were that there is a potential market for use of reclaimed water and that water can be produced with a bacterial quality high enough to allow its use for all forms of irrigation.

The Cities which are the retail water agencies in the study area have now taken over the responsibility of obtaining commitments from potential water users. When these contracts are completed, the design and construction of a distribution system based upon the needs of the water users would commence.

2.4 Water Reclamation Study, Santa Clara Valley

The purpose of this study is to evaluate the potential for use of reclaimed water in the east and central portions of the North Valley and in the South Valley. This study was conducted jointly by the Santa Clara Valley Water District and the Department of Water Resources. Preliminary results of this study show that surface water deliveries of reclaimed water in the study area is prohibitively expensive. The study will now be directed toward investigating the feasibility of distributing reclaimed water by recharging it into the groundwater basins. A report detailing this work will be available in early 1980.

2.5 San Francisco Bay Area Regional Wastewater Reclamation Study

The San Francisco Bay Area Water Reuse Study is sponsored by a 14 member Joint Powers Agency including Santa Clara Valley Water District..

This study is a two-phase study to develop a regional long-range wastewater reclamation facilities plan which will provide for the maximum reuse of Bay Area wastewater and recommend an implementation program consistent with on-going and proposed subregional programs.

In Phase I, now completed, the goals were to: identify the major potential markets for reuse of Bay Area wastewater; provide an updated characterization of wastewater sources in the nine-county Bay Area; evaluate and update previously studied regional water reclamation projects; identify specific implementation constraints of wastewater reuse and propose methods to overcome or resolve these constraints; and identify and recommend specific projects for additional study in Phase II.

Phase II of the water reuse study will focus on those major markets which have the greatest potential for beneficial use, considering the total water resources in California.

3. Water Savings Program

Water savings is and always has been an integral part of the District's overall water supply program. During the drought, the program effort was increased in conjunction with the District's Board of Directors' call for all citizens to voluntarily reduce water use by 25 percent.

Subsequent to the above average rainfall of 1977-78, when it became apparent that an adequate water supply was available for meeting the County's population water needs, the District reduced its emergency goal of a 25 percent reduction in water use and established a goal to maintain permanently a water savings of at least ten percent on the basis of pre-drought levels of use in order to ensure a balanced water supply for the future. The water savings program continues with this new goal in mind.

During 1978-79, an educational team, supported mostly by federal funds (CETA) was used to teach school groups and the general public to participate in the Water Savings Program. Presentations were given to over 20 thousand students.

Conservation films were distributed to area libraries, theatres, and other media centers for use by the general public and all schools. As a result of this and other programs, such as distribution of materials to more than 30 thousand grades K-12 students, and with the cooperation of the citizens, the ten percent reduction in water use was accomplished in both the North and South County in 1978-79.

D. Surface Water Quality

1. Streams

Surface waters of the Santa Clara Valley are generally of adequate mineral quality.

The surface water quality monitoring program in 1978-79 included ten stream sampling stations and limnological investigations of three reservoirs, Coyote, Anderson and Lexington.

The stream monitoring stations were located at existing streamflow stations and were sampled during the report period for specific conductance, pH, temperature, DO, hardnesses, Ca, Mg, Na, SAR, sodium percent, K, alkalinity, SO_4, C_1, F, SiO_2, solids, total, dissolved N (NO_2 NO_3 NH_3 and organic) total phosphorus, dissolved metals (Al, B, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Zn), and TOC.

Except for the metals and TOC which were measured twice, all the other parameters were measured eight times during the report period. The stream monitoring stations are located at the following stream flow stations:

Los Gatos Creek

Station 67	-	below Lexington Reservoir
Station 59	-	at Lark Avenue
Station 50	-	at Lincoln Avenue

Guadalupe Creek

Station 43	-	at Los Gatos Golf Course
Station 20	-	at Alamitos Recharge System
Station 16900	-	downtown San Jose

Coyote Creek

Station 9	-	below Anderson Reservoir
Station 58	-	at Edenvale

Llagas Creek

Station 69	-	below Chesbro Reservoir
Station 11158555	-	25 feet upstream of Machado School
Station 11153530	-	at San Martin Avenue

The data collected will be used to identify long term variations in quality and evaluate the effects of change in land use and other activities on the quality of water of in streams in Santa Clara County.

2. Reservoirs

Since 1974, the District has been conducting liminologic investigations of the conservation reservoirs. Limnology is the study of physical, chemical, and biological conditions of a freshwater body, and its tributary streams and watershed. During

1978-79 the limnologic program consisted of sampling Anderson and Coyote Reservoirs once and Lexington Reservoir four times.

Anderson and Coyote Reservoirs have been studied in depth and are now sampled on a once-a-year frequency to detect changes in quality. Lexington is now undergoing a comprehensive investigation. During the report period all the data collected reflected conditions of the reservoir at less than 60 percent of capacity. This investigation will continue next year when data will be collected for the the reservoir at full or near full capacity. Upon completion of the Lexington Reservoir investigation, other reservoirs will be studied.

The product of these investigations is a collection of adequate base-line water quality data for each reservoir. Evaluation of the information collected during regular monitoring and observation of water quality trends aids in the identification of sources of contamination, will aid in predicting the impact of projected land use changes in the watersheds and will be a valuable tool in the selection of reservoir operation criteria.

VI. GLOSSARY*

Acre-Foot - A measurement of volume of water equaling 43,560 cubic feet or 325,851 gallons, an amount that would cover an area of an acre, one foot deep (a football field would be covered one and a quarter feet deep).

Aguifer - A geologic formation that stores, transmits, and yields significant quantities of water to wells and springs.

Aquitard - A geologic formation which, although porous and may store large quantities of water, will not transmit water fast enough to yield an appreciable supply for a well.

Artesian Well - A well in which water is lifted by hydrostatic pressure above the land surface at the well.

Biochemical Oxygen Demand (BOD) - The quantity of oxygen consumed in biological processes that decompose organic matter in water.

Confined Aquifer - An aquifer overlain by material sufficiently impervious to retain groundwater in the aquifer under pressure.

Connate Water - Water which was entrapped in a geologic formation at the time the formation was deposited. If the formation was deposited in the ocean or a saline lake, the connate water is also saline.

Consumptive Use - Water consumed by vegetative growth in transpiration and building of plant tissue, and water evaporated from adjacent soil, from water surfaces, and from foliage. Also, water similarly consumed and evaporated by urban and nonvegetative types of land use.

Contamination - An impairment of the quality of water by micro-organisms, chemicals, sewage, or industrial waste which renders the water unfit for its intended use. In California, this means the water constitutes an actual hazard to public health (see also Pollution).

Cubic Feet Per Second (CFS) - A unit of measurement of flowing water; the number of cubic feet of water which passes a given point in a second.

Dissolved Oxygen (D.O.) - The oxygen dissolved in water. It is necessary for aquatic life.

Dry Period - An historic period of years when water supply is much below normal. An example was 1929-34 when the water in northern California streams averaged only about 38 percent of normal. It has been used as the reference drought situation in much water resource planning.

Evaporation - The process by which surface or subsurface water is converted to atmospheric vapor.

* From Santa Clara Valley Water District's "Glossary of Terms", April, 1977.

Evapotranspiration - Water withdrawn from soil by evaporation and plant transpiration (a consumptive use).

Flood Insurance - The transfer of the risk of monetary loss due to flooding to another in accordance with the National Flood Insurance Program.

Floodplain - The relatively flat area adjoining a river or lake that may be covered by floodwater.

Gradient - The rate of change per unit of length, such as the slope of the land, stream channel, or any surface.

Groundwater - Subsurface water in saturated porous rocks and soils.

Groundwater Basin - Areas where water is stored below the ground surface.

Groundwater Recharge - The process whereby water seeps from the surface down through soil materials to become groundwater.

Groundwater Recharge Basins - Depressions where water is placed so that it can seep into the ground.

Hydrologic Cycle - The circuit of water movement from the atmosphere to the earth and return to the atmosphere through various stages of precipitation, consequent runoff, streamflow, infiltration and underground movement, eventual evaporation, and reprecipitation.

Hydrology - The applied science concerned with the waters of the earth in all its states - their occurrences, distribution, and circulation through the unending hydrologic cycle.

Hydrology, Groundwater - The branch of hydrology that deals with groundwater, its occurrence, movement, replenishment, and depletion.

Imported Water - Water that is moved from one drainage basin to another. (Example: Water is moved from the Sacramento-San Joaquin Valleys through canals and pipelines into the Santa Clara Valley.)

Infiltration - The movement of water through the soil surface and into the soil.

Injection Well - Well used for introduction water into an aquifer. Technique used to stop seawater intrusion, replenish an aquifer, or dispose of cooling water.

Overdraft - The condition in a groundwater basin where the amount of water withdrawn by pumping exceeds the amount of water replenishing the basin over a long time period.

Perched Groundwater - Groundwater occurring in a saturated zone separated from the main body of groundwater by unsaturated rock (or soil).

Percolation - The movement of water, under natural pressures developed underground, through the interstices of the rock or soil.

Percolation Pond - See Groundwater Recharge Basin.

Permeability - A measure of the ability of a material to convey water.

Piezometric Level - The level to which water will rise in a well that penetrates a confined aquifer.

Point Source - Any discernible confined and discrete conveyance from which pollutants are or may be discharged.

Pollution -The addition of sewage, industrial wastes, or other harmful or objectionable material to water (see also Contamination).

Potable Water - Water which does not contain objectionable pollution, contamination, minerals, or infection and is considered satisfactory for domestic consumption.

Precipitation - The total measurable supply of water received from clouds as rain, snow, hail, or sleet.

Primary Treatment - The first major stage in wastewater treatment, usually sedimentation. Floating and settleable solids are removed in this stage.

Salinity - The concentration of salts dissolved in water.

Secondary Treatment - The second major step in wastewater treatment using biological methods to decompose the organic wastes carried by the water.

Semiperched Groundwater - Shallow groundwater overlying a body of groundwater from which it is not separated by any unsaturated alluvium (perched groundwater but not separated by an unsaturated zone from the main groundwater body; separation is achieved by the nearly impermeable nature of the perching clay layer and if the main groundwater body were drawn down, a true perching condition would result).

Spreading Dam - A low artificial barrier built in a stream to pond water to increase groundwater recharge capacity.

Subsurface Inflow - Underground waters of the hills and mountains or adjacent groundwater basins that move into the groundwater basin under consideration. This water is subsurface outflow from the hills and mountains or the adjacent grondwater basin.

Surface Diversion - The taking of water from a stream or other body of surface water into a canal, pipeline, or other conduit.

Surface Water - Water that rests on the surface of the earth, such as streams and rivers, ponds, lakes, and reservoirs.

Suspended Solids (SS) - Small particles of matter that are carried in suspension in water.

Tertiary - Treatment processes in addition to the normal secondary treatment of wastewaters. Generally, these are chemical and physical processes.

Total Dissolved Solids (TDS) - The amount of organic and inorganic matter (by weight) dissolved in a given quantity of water. It is usually stated in parts per million (ppm) or milligrams per liter (mg/l).

Treated Water - Water that has been treated to make it suitable for domestic service (see Potable Water).

Turbidity - A measure of fine suspended matter (usually colloidal) in liquids. The fine particles may be visible as a bulk unit but are not large enough to be seen as individual particles by the naked eye; in total they restrict the passage of light through the liquid.

Unconfined Aquifer - An aquifer such that the piezometric surface of the groundwater retained within it falls below the bottom of any upper confining bed.

Water Quality - The chemical, physical, and biological properties of water which affect its suitability for use.

Watershed - The land area from which water drains to a given point (a drainage area, drainage basin, or catchment area).

Water Table - The surface where groundwater is encountered in a well in an unconfined aquifer.

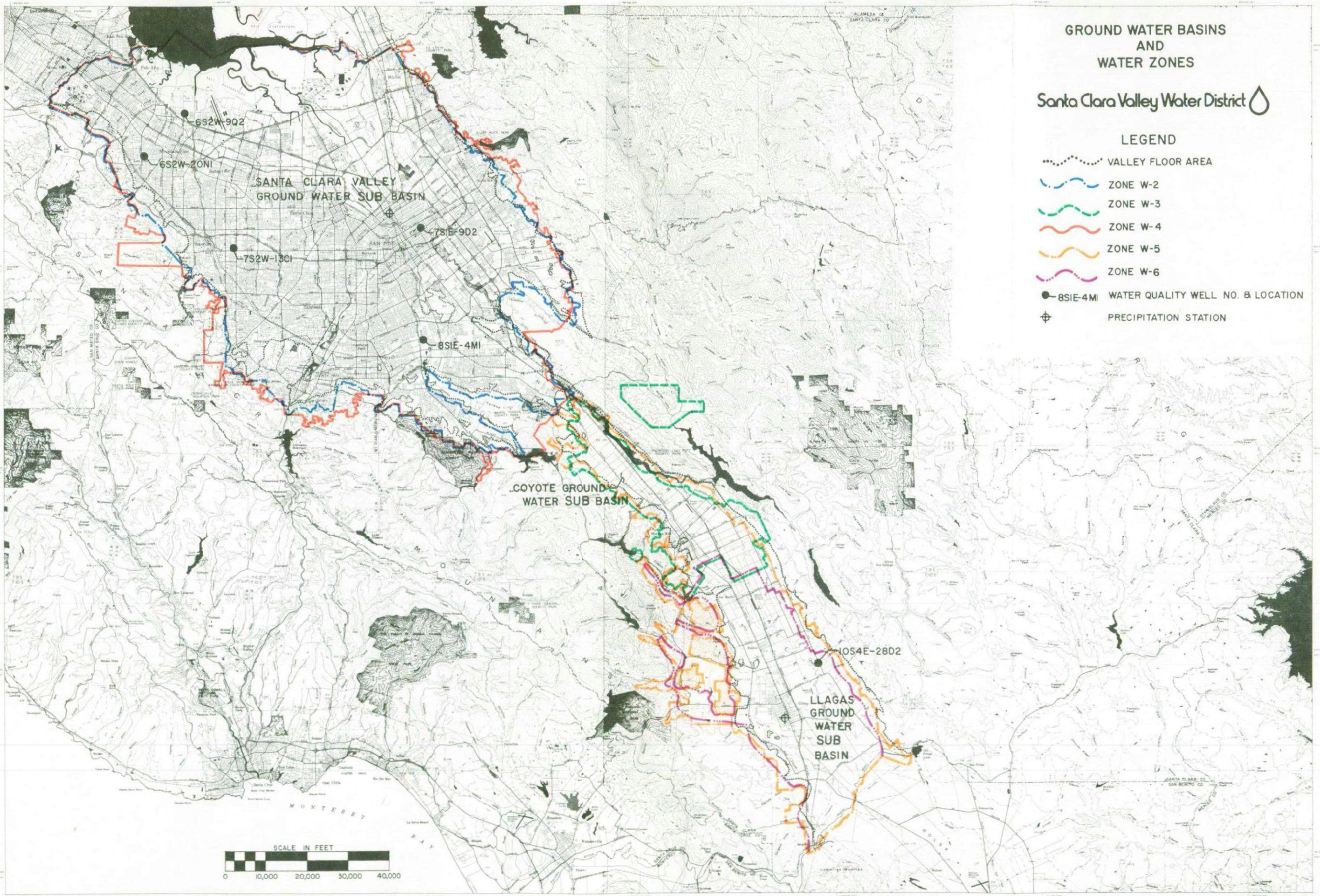

GROUND WATER BASINS
AND
WATER ZONES
Santa Clara Valley Water District
LEGEND
VALLEY FLOOR AREA
ZONE W-2
ZONE W-3
ZONE W-4
ZONE W-5
ZONE W-6
8S1E-4M1 WATER QUALITY WELL NO. & LOCATION
PRECIPITATION STATION
6S2W-9Q2
6S2W-20N1
SANTA CLARA VALLEY
GROUND WATER SUB BASIN
7S1E-9D2
7S2W-13C1
8S1E-4M1
COYOTE GROUND
WATER SUB BASIN
10S4E-28D2
LLAGAS
GROUND
WATER
SUB
BASIN
MONTEREY
BAY
SCALE IN FEET
0
10,000
20,000
30,000
40,000

PLATE 1

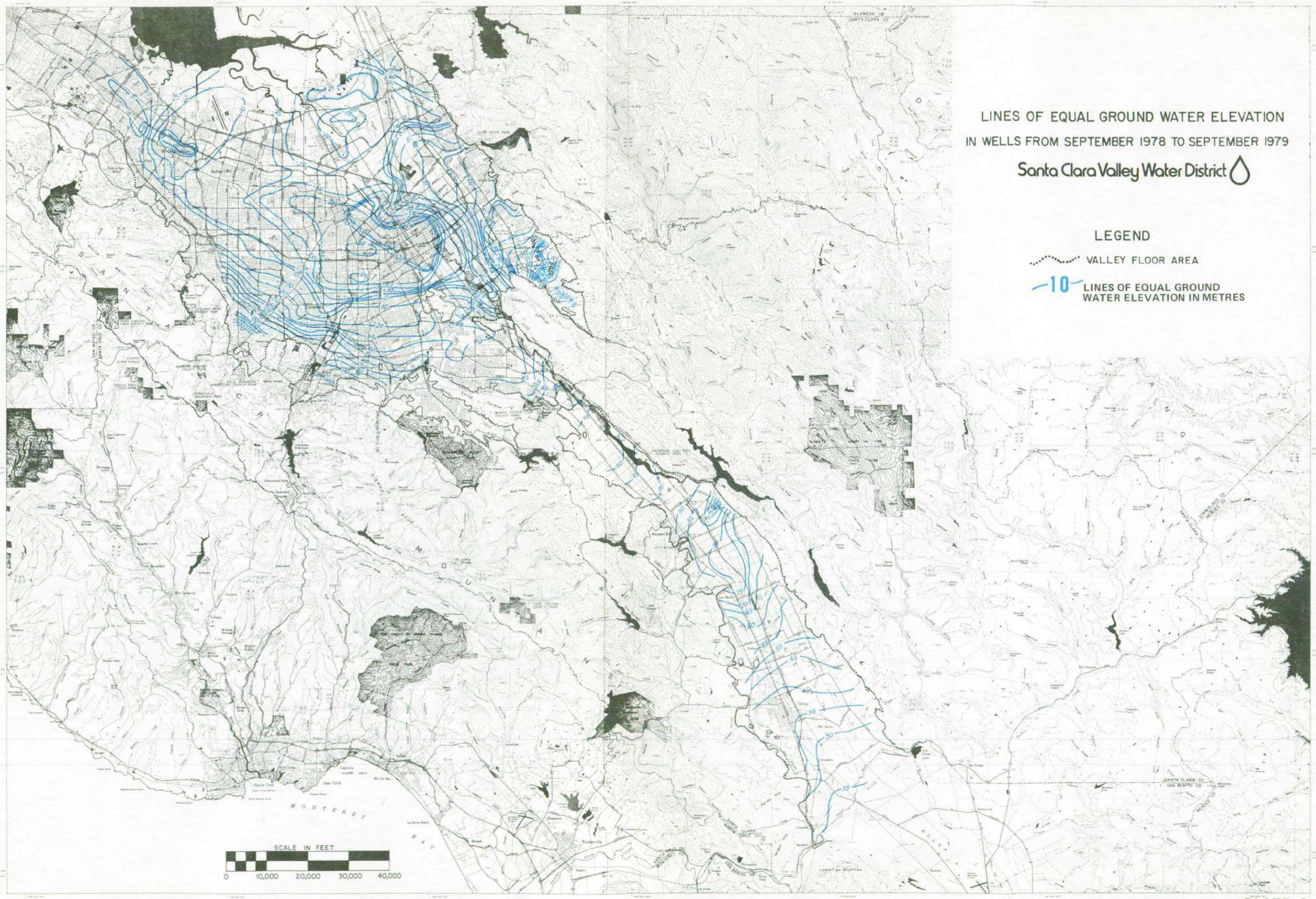

LINES OF EQUAL GROUND WATER ELEVATION
IN WELLS FROM SEPTEMBER 1978 TO SEPTEMBER 1979
Santa Clara Valley Water District
LEGEND
VALLEY FLOOR AREA
10
LINES OF EQUAL GROUND WATER ELEVATION IN METRES
SCALE IN FEET
0
10,000
20,000
30,000
40,000
MONTEREY BAY
SANTA CRUZ MOUNTAINS
SANTA CLARA VALLEY
Palo Alto
San Jose
Santa Cruz
Watsonville
ALAMEDA CO
SANTA CLARA CO
SAN MATEO CO
SANTA CRUZ CO
SAN BENITO CO

PLATE 2

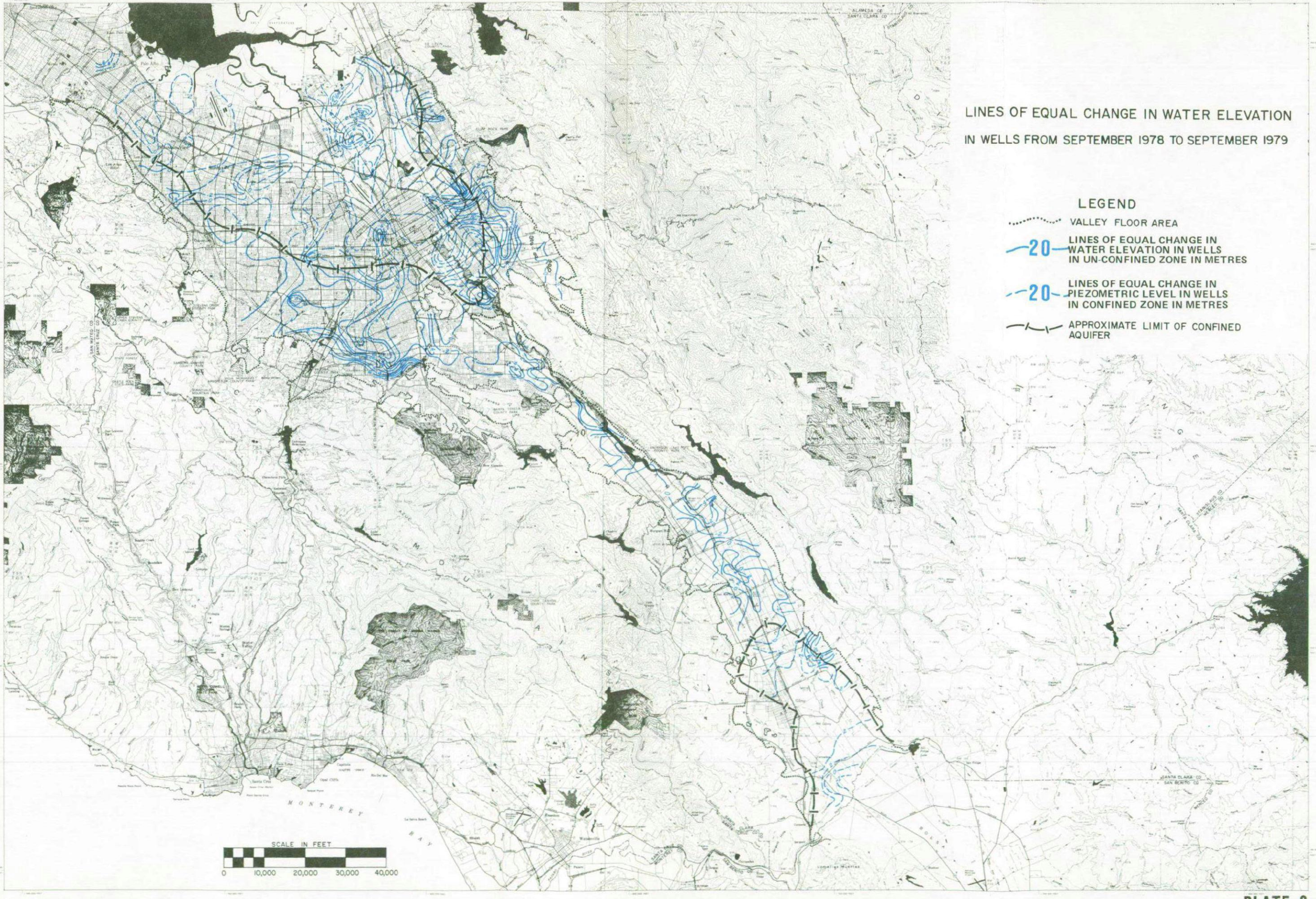
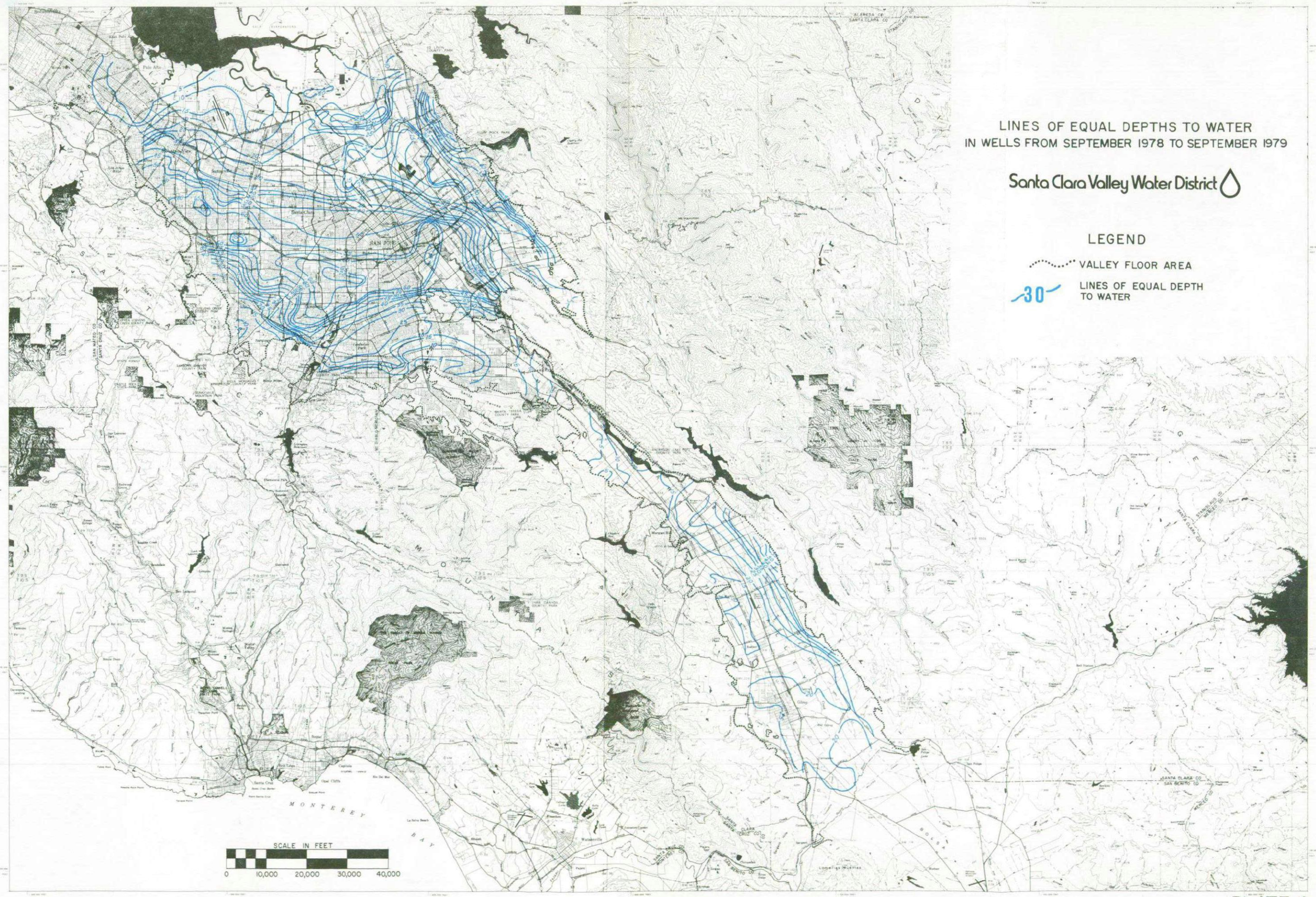
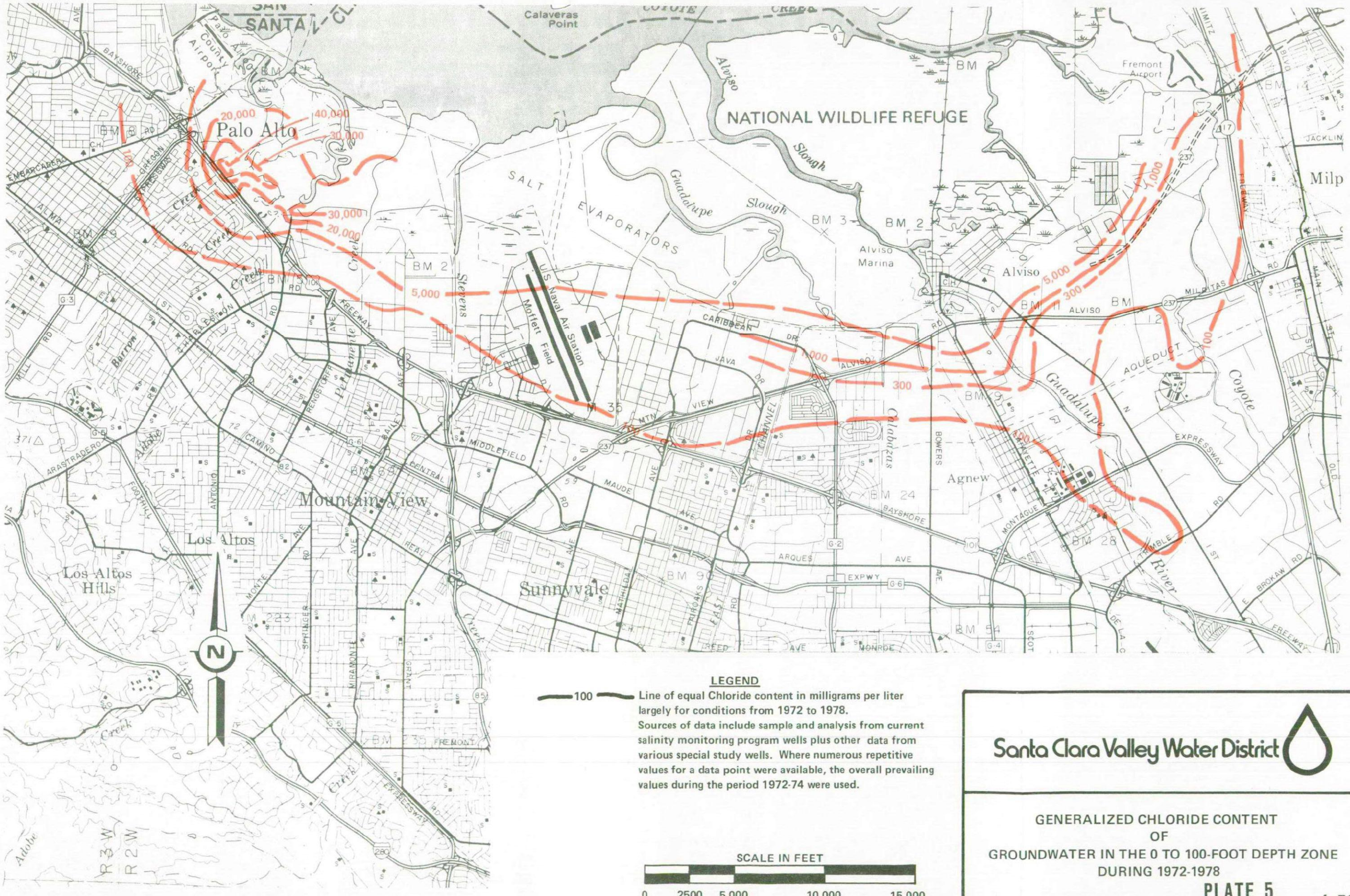

LINES OF EQUAL CHANGE IN WATER ELEVATION
IN WELLS FROM SEPTEMBER 1978 TO SEPTEMBER 1979
LEGEND
VALLEY FLOOR AREA
20
LINES OF EQUAL CHANGE IN WATER ELEVATION IN WELLS IN UN-CONFINED ZONE IN METRES
20
LINES OF EQUAL CHANGE IN PIEZOMETRIC LEVEL IN WELLS IN CONFINED ZONE IN METRES
APPROXIMATE LIMIT OF CONFINED AQUIFER
SCALE IN FEET
0
10,000
20,000
30,000
40,000
MONTEREY
BAY

PLATE 3


LINES OF EQUAL DEPTHS TO WATER
IN WELLS FROM SEPTEMBER 1978 TO SEPTEMBER 1979
Santa Clara Valley Water District
LEGEND
VALLEY FLOOR AREA
30
LINES OF EQUAL DEPTH TO WATER
SCALE IN FEET
0
10,000
20,000
30,000
40,000
MONTEREY BAY
SANTA CLARA VALLEY
SAN JOSE
Santa Clara
Palo Alto
Morgan Hill
Gilroy
Watsonville
Santa Cruz
Capitola
Opal Cliffs
Los Gatos
Los Altos
Los Altos Hills
Mountain View
Sunnyvale
Cupertino
Saratoga
Campbell
Milpitas
Alviso
Coyote
Hollister
San Felipe
Aromas
Ben Lomond
Felton
Boulder Creek
Scotts Valley
Soquel
Aptos
Rio Del Mar
Corralitos
Freedom
Pajaro
Moss Landing
Elkhorn Slough
Elephant Rock
Elephant Rock Point
Point Santa Cruz
Santa Cruz Point
Capitola Point
Rio Del Mar Point
Tanner Point
Cowell Point
Seacliff Point
Aptos Point
Soquel Point
Capitola Point
Opal Cliffs Point
Moss Landing Point
Elkhorn Slough Point
Point Santa Cruz
Santa Cruz Point
Tanner Point
Cowell Point
Seacliff Point
Aptos Point
Soquel Point
Capitola Point
Opal Cliffs Point
Rio Del Mar


Palo Alto
Mountain View
Los Altos
Los Altos Hills
Sunnyvale
Alviso
Agnew
Milp
NATIONAL WILDLIFE REFUGE
SALT EVAPORATORS
Alviso Slough
Guadalupe Slough
Calaveras Point
Fremont Airport
Alviso Marina
U.S. Naval Air Station
Moffett Field
Guadalupe River
Coyote Creek
Stevens Creek
Permanente Creek
Adobe Creek
Barron Creek
20,000
40,000
30,000
5,000
1,000
300
100
R 3 W
R 2 W
N
LEGEND
100 Line of equal Chloride content in milligrams per liter largely for conditions from 1972 to 1978.
Sources of data include sample and analysis from current salinity monitoring program wells plus other data from various special study wells. Where numerous repetitive values for a data point were available, the overall prevailing values during the period 1972-74 were used.
SCALE IN FEET
0 2500 5,000 10,000 15,000
Santa Clara Valley Water District
GENERALIZED CHLORIDE CONTENT
OF
GROUNDWATER IN THE 0 TO 100-FOOT DEPTH ZONE
DURING 1972-1978
PLATE 5
4-78